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A REVISION OF THE BORAGINACEAE OF WEST PAKISTAN AND KASHMIR

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THE TREATMENT OF THE BORAGINACEAE for Hooker's *Flora of British India* (4: 137–179. 1883) was prepared by C. B. Clarke. The area then comprised the present states of India, Pakistan, Kashmir, Nepal, Burma, and Ceylon. Many other authors have since contributed to the flora of West Pakistan and Kashmir but most of their publications are of regional nature or only enumerations of plants collected by them from different parts of the country.

Since C. B. Clarke's work no comprehensive revision of Boraginaceae of West Pakistan and Kashmir has been prepared. The additional information we have on this area is scattered in the following general works or in the revisions of this family for some of the adjoining areas.

In 1924 I. M. Johnston reviewed the Old World genera of the Boraginaceae, subfamily Boraginoideae (Contr. Gray Herb. 73: 42–73. 1924). His observations on some genera and species of our area appeared in scattered papers (Contr. Gray Herb. and Jour. Arnold Arb.) published between 1924 and 1957. Brand, from 1921 to 1931 (in Engler, *Pflanzenreich* IV. 252 (Heft 78): 1–183. 1921; IV. 252 (Heft 97): 1–236. 1931) revised several groups of Boraginaceae, including many genera and species from West Pakistan and Kashmir. Later the family was revised by Popov (*Fl. URSS* 19: 97–691. 1953). His revision is confined to the plants of URSS, but gives information on those species with distribution extended to West Pakistan and Kashmir.

Recently, H. Riedl (in Rechinger, *Fl. Iranica* 48: 1–266. 1967) dealt with the Boraginaceae of the Iranian Highlands, an area including the parts of West Pakistan westwards to the Indus; but the areas lying eastwards to the Indus and adjoining Kashmir and Jammu have been excluded as not being a part of the Iranian Highlands. His work is a valuable contribution to the study of Boraginaceae of West Pakistan as it gives the western limits of distribution of West Pakistan taxa and indicates their relationship with allied species of westerly distribution.

In the present paper an attempt has been made to revise the Borag-

inaceae of West Pakistan, east and west of the Indus and the whole State of Jammu and Kashmir, with a special interest in determining the eastern limits of distribution of the taxa of this area and their eastern relatives.

This revision is the result of a critical examination of the material accumulated at the Herbaria of the Arnold Arboretum and Gray Herbarium of Harvard University, including most of the collections of Stewart, Koelz, and Webster from India, Pakistan, and Kashmir and many other collections received from the Royal Botanic Gardens, Calcutta, the Forest Research Institute, Dehra Dun, and St. Xavier's College, Bombay, which were the object of studies of the late I. M. Johnston for over thirty years. My own collections, especially those made with Professor K. H. Rechinger and Miss J. Lamond in West Pakistan in 1965, which are preserved at the North Regional Laboratories, Peshawar, and the material I received on loan from other herbaria.

The following abbreviations¹ (from Lanjouw & Stafleu, *Index Herbariorum*, ed. 5) are used in the citation of specimens.

Arnold Arboretum (A)

British Museum (Natural History) (BM)

Royal Botanic Garden, Edinburgh (E)

Pakistan Forest Institute, Medicinal Plant Branch, Peshawar (PFI-M)

Conservatoire et Jardin Botaniques, Genève (G)

Gray Herbarium (GH)

Islamia College, Peshawar (ICP)

Karachi University (KAU)

Punjab University, Lahore (LAH)

University of Michigan, Ann Arbor (MICH)

North Regional Laboratories, Peshawar (PES)

Peshawar University (PEU)

Gordon College, Rawalpindi (RAW)

Naturhistorisches Museum, Wien (W)

U.S. National Museum, Washington, D.C. (US)

Other abbreviations, used in the citation of TYPE specimens, are also according to Lanjouw & Stafleu.

I am greatly obliged to Dr. Richard A. Howard, Director of the Arnold Arboretum, for the facilities of work provided for me at the Harvard University Herbaria under a Mercer Research Fellowship. I am also thankful for very courteous treatment, which I have received from the members of the staffs of the Arnold Arboretum and the Gray Herbarium. I am extremely indebted to Mr. B. L. Burtt of the Royal Botanic Garden, Edinburgh, and Dr. R. R. Stewart of the University of Michigan Herbarium for their encouragement, advice, and some very useful suggestions. I wish to express my thanks to Dr. Robert C. Foster for correcting my Latin diagnosis, to Dr. Bernice G. Schubert for making editorial corrections and to the Directors and Curators of the herbaria, who were kind enough to send material on loan for my studies.

¹ The symbols for the five herbaria in West Pakistan not included in *Index Herbariorum*, ed. 5, were suggested by Dr. F. A. Stafleu in a personal communication.

In the systematic account which follows, I have cited all the material I have examined. I have tried to arrange the collections in geographical sequence, grouping them under West Pakistan and Kashmir and their respective districts arranged alphabetically. The collections which, due to lack of information, could not be placed in any district, have been listed under Miscellaneous. I have not changed the spelling of the localities or the language of the collector's notes. In cases where the sheets were not numbered by collectors, I have given the herbarium number or any other indication, which might be useful in recognizing the sheet.

BORAGINACEAE JUSS. Gen. Pl. 128. 1789 "Borragineae"

Syn.: *Boraginaceae* Lindl. Nat. Syst. ed. 2. 274. 1836; G. Don, Gen. Syst. 4: 306. 1838. *Asperifoliae* L. Ord. Nat. Pl. 489. 1792. *Asperifoliaceae* Reichenb. Concept. Regni Veg. 118. 1828.

Herbs, shrubs or trees, usually scabrous, hispid hairy, sometimes glabrous. Leaves generally alternate, lowermost sometimes opposite, simple, usually entire, exstipulate. Inflorescence usually composed of 1 or more scorpioid or helicoid cymes that uncoil as the flowers open, or sometimes glomerate-racemose or spicate, sometimes loosely cymose or with solitary flowers, bracteolate or not. Flowers mostly bisexual, actinomorphic or rarely zygomorphic, hypogynous. Calyx usually regular, sometimes irregular, sepals 5, distinct or basally connate, imbricate or rarely valvate. Corolla 5-lobed, imbricate or contorted in bud, rotate, salverform, funnel-form or campanulate; corolla tube with folds, sometimes terminated or partially closed by faucal appendages (scales). Stamens 5, epipetalous, equal or less commonly unequal, alternating with corolla lobes; anthers 2-celled, dehiscing longitudinally, basifixed or basally dorsifixed, introrse; annular nectariferous disc present or absent. Ovary superior, bilocular but becoming 4-locular at maturity; ovules anatropous or hemitropous; style terminal or gynobasic, long or short; stigma capitate or 2-lobed or sometimes style twice bifid. Fruit drupaceous or dividing into two bilocular or 4 unilocular (or one 4-locular) nutlets; seeds erect or oblique, testa membranous, albumen fleshy, embryo curved, radical superior.

A family of wide distribution, composed of about 100 genera and 2,000 species. About 60 genera are represented in the Old World including 36 in West Pakistan and Kashmir.

KEY TO THE GENERA

1. Trees or shrubs.
 2. Style 4-fid. 1. *Cordia*.
 2. Style 2-fid. 2. *Ehretia*.
1. Herbs, annual, biennial or perennial, rarely undershrubs.
 3. Style terminal on the entire ovary, not inserted between the carpels.
 4. Styles 2. 3. *Coldenia*.
 4. Style 1 (to bifid). 4. *Heliotropium*.

3. Style arising from between the carpels.
 5. Ovules 2, always 2 nutlets developed. 18. *Rochelia*.
 5. Ovules 4, nutlets 4 at least when immature, rarely 1-3 abortive (but at younger stage always 4).
 6. Apices of anthers subulate and contorted. 30. *Trichodesma*.
 6. Apices of anthers obtuse or apiculate, not subulate or contorted.
 7. Anthers strongly heteromorphic, the upper ones several times longer than the lower. 31. *Caccinia*.
 7. Anthers homomorphic, all of equal size.
 8. Faucal appendages (scales) absent, corolla throat sometimes villous, corolla tube usually longitudinally plicate.
 9. Anther connectives elongated, sterile; corolla lobes reduced to teeth. 29. *Onosma*.
 9. Anther connectives not elongated; corolla lobes distinct.
 10. Gynobase elevated, pyramidal, more than half the length of the nutlets (corolla in W. Pakistan species strongly zygomorphic). 7. *Echiochilon*.
 10. Gynobase plane; corolla actinomorphic.
 11. Corolla throat densely filled with hairs; style undivided, stigma 1. 5. *Sericostoma*.
 11. Corolla throat naked, sometimes gibbous; style divided, stigma 2-4.
 12. Corolla throat glabrous, never gibbous; style 2-4-fid, rarely undivided; stigmas 2-4. 28. *Arnebia*.
 12. Corolla throat gibbous; style 2-fid, stigmas 2. 27. *Lithospermum*.
 8. Faucal appendages (scales) present, sometimes represented only by hairs or minute glands (except in *P. parviflora* and *P. echioides*).
 13. Appendages 10, in two tiers, 5 alternating with the corolla lobes, the other 5 alternating with the stamens in the corolla tube. 34. *Decalipidanthus*.
 13. Appendages 5, in one tier, alternating with the stamens or corolla lobes in the corolla throat.
 14. Nutlets neither glochidiate-appendiculate nor prickly, smooth, granulate, verruculose, tuberculate or variously rugulose, glabrous or hirtulous.
 15. Calyx irregular, divided to the middle, dentate between the lobes, much enlarged at fruiting, compressed, subbilabiate, lobes dentate or lobate. 19. *Asperugo*.
 15. Calyx regular, lobes subequal, not dentate between the lobes, not much enlarged at fruiting, neither compressed nor bilabiate, lobes not dentate or lobate.
 16. Faucal appendages velvety or fimbriate, areola of nutlet prominently hollowed out by a thickened girdle. 33. *Nonea*.
 16. Faucal appendages usually glabrous or puberulous, never fimbriate, areola of nutlet various.

17. Areola of nutlet concave with distinct smooth or slightly dentate but not thickened girdle.
18. Areola of nutlet basal, if subventral corolla tube geniculate. 32. *Anchusa*.
18. Areola of nutlet ventral; corolla tube always erect. 35. *Gastrocotyle*.
17. Areola of nutlet neither concave nor girdled.
19. Lower flowers distant, axillary, upper flowers in foliate spikes; corolla sinuate, tubular; areola basal, rims thick, ventrally developed. . . 6. *Bothriospermum*.
19. Flowers never axillary; inflorescence bracteate or ebracteate; corolla various; areola without rim or collar.
20. Areola of nutlet affixed subventrally to the gynobase. 11. *Lasiocaryum*.
20. Areola of nutlet affixed ventrally, suprabasally or medially to the gynobase.
21. Corolla salverform, throat not differentiated, tube usually shorter than the calyx lobes; nutlets usually rough, attached ventrally, suprabasally or medially. 9. *Anoplocaryum*.
21. Corolla tubular with well developed campanulate or funnel-formed throat, tube usually surpassing the calyx lobes; nutlets usually smooth, attached basally or suprabasally.
22. Corolla deep purple-blue, lobes at most equalling the tube, usually shorter; nutlets keeled. 8. *Pseudomertensia*.

22. Corolla sky-blue to white, lobes at least equalling the tube, usually longer; nutlets not to scarcely keeled. 36. *Myosotis*.
14. Nutlets at the margin and in the middle area glochidiate-appendiculate, usually winged (in *Lappula* sometimes reduced to tubercles or prickles).
23. Gynobase flat; nutlets regularly tetrahedral, attached at one corner. 14. *Trigonotis*.
23. Gynobase conical, pyramidal or subulate; nutlets not tetrahedral, variously attached.
24. Nutlets with an elongate total lateral attachment to the gynobase, commonly decurrent on style.
25. Wings of nutlets incurved, middle area partly covered. 21. *Paracaryum*.
25. Wings of nutlets not or rarely slightly incurved, middle area never covered. 22. *Mattiastrum*.
24. Nutlets variously attached to the gynobase, not decurrent on style.
26. Nutlets with straight or uncinata, unicellular hairs, never tuberculate nor with multicellular glochidiate appendages, rarely smooth and glabrous (but if so always with stamens included). 20. *Omphalodes*.
26. Nutlets with some or more multicellular glochidiate appendages or evidently tuberculate, rarely smooth and glabrous (but then with stamens always exerted).
27. Middle area of nutlet distinctly ovate, apex acute, inner face above areola keeled throughout its length. 16. *Lepechiniella*.
27. Middle area of nutlet if distinct, oblong-ovate, trapeziform to narrowly triangular, inner face above the areola not at all keeled throughout its length.
28. Nutlets inseparable from the gynobase, bases of the marginal glochidiate appendages usually confluent. 17. *Heterocaryum*.
28. Nutlets separable from the gynobase, bases of marginal

glochidiate appendages usually not confluent.

29. Nutlets globose, semiglobose or napiform.
30. Filaments evidently longer than anthers, attached above faucal appendages, anthers and filaments exceeding the corolla. 23. *Solenanthus*.
30. Filaments equalling the anthers, not inserted above the faucal appendages, anthers included or rarely slightly exceeding the corolla.
31. Nutlets with very few glochidiate appendages and with a well developed wide cartilaginous margin. 26. *Actinocarya*.
31. Nutlets with many glochidiate appendages, marginless or with a weakly developed margin, thick, and evidently formed by the basal fusion of the lateral appendages.
32. Anthers at maximum 3 times longer than broad. 25. *Cynoglossum*.
32. Anthers often more than 3 times longer than broad. 24. *Lindelofia*.
29. Nutlets more or less pyramidal to truncate-pyramidal-oblong.
33. Nutlets about equalling the elongate gynobase, attached for nearly the whole length, (with rare exceptions) exceeded by style, margins of nutlets toothed or lacerate, frequently glochidiate-appendiculate. 15. *Lappula*.
33. Nutlets much surpassing the stout pyramidal gynobase, attached obliquely and supramedi ally by the deltoid or ovate areola, surpassing the style.
34. Nutlets (some or all of each fruit) with a thick medial, dorsal, annulate crest. 13. *Microula*.
34. Nutlets with a circumdorsal, commonly lacerate or dentate margin.
35. Fruiting calyx reflexed; rank tufted plants with broad herbaceous leaves. 12. *Hackelia*.
35. Fruiting calyx erect or ascending; low densely cespitose plants with small firm leaves. 10. *Eritrichium*.

1. *Cordia* L. Sp. Pl. 190. 1753; Gen. Pl. ed. 5. 87. 1754

TYPE SPECIES: *C. myxa* L.

Trees or shrubs. Leaves small to large, usually evidently petiolate, margins entire, serrate, or rarely evenly lobulate. Inflorescence of ebracteate cymes, mostly corymbose. Flowers homomorphic, or heterostyled, or functionally more or less unisexual (functionally male flowers with style and stigmas much reduced or completely undeveloped); corolla campanulate to funnelform, small to large, white, yellow-orange or red, usually 5-merous but occasionally 4-8-merous, lobes ascending to recurved, tube short to long, cylindrical or spreading; stamens exerted to included, filaments often hairy towards the base, usually well developed; style terminal on ovary, dichotomous, a simple column at base then dividing into 2 branches, which in turn fork to produce the 4 ultimate branches each bearing a stigma; stigmas 4, clavate to spatulate or capitate. Fruit a drupe with watery or glutinous mesocarp or rarely without fleshy

mesocarp and hence a nut; endocarp bony, 1-4-seeded. Seeds without endosperm.

About 250 species, mainly of the American tropics.

KEY TO THE SPECIES

- a. Leaves once and a half to twice as long as broad.
 - b. Corolla tube longer than corolla lobes, lobes \pm 3 mm. long. 1. *C. gharaf*.
 - b. Corolla tube shorter than corolla lobes, lobes 5-6 mm. long. 2. *C. dichotoma*.
- a. Leaves less than one and a half times as long as broad, frequently as broad as long.
 - c. Calyx not ribbed, glabrous externally. 3. *C. obliqua*.
 - c. Calyx ribbed, pubescent or tomentose externally.
 - d. Leaves cordate or rounded at the base; corolla tube glabrous within. 4. *C. macleodii*.
 - d. Leaves cuneate or rounded at the base; corolla tube hairy within.
 - e. Pedicel tomentose; calyx \pm 10 mm. long. 5. *C. vestita*.
 - e. Pedicel subglabrous; calyx 3-4 mm. long. 6. *C. myxa*.

1. ***C. gharaf*** (Forssk.) Ehren. ex Asch. Sitz-ber. Ges. Naturf. Freunde 1879: 46. 1879; Verh. Bot. Ver. Brandenb. 21(2): 69. 1880; Muschler, Man. Fl. Egypt 2: 781. 1912.

Cornus gharaf Forssk. Fl. Aegypt.-Arab. xcv. 1775.

Cornus sanguinea Forssk. *Ibid.* 33. 1775, non L.

Cordia sinensis Lam. Encycl. Méth. Bot. 1: 423. 1791; I. M. Johnston, Jour. Arnold Arb. 32: 11. 1951.

Cordia rothii Roem. & Schult. Syst. Veg. 4: 798. 1819; DC. Prodr. 9: 480. 1845; Brandis, Forest Fl. India 338. 1874, Indian Trees 480. 1921; C. B. Clarke in Hook. f. Fl. Brit. India 4: 138. 1883; Cooke, Fl. Bombay Presidency 2: 202. 1908; Parker, Forest Fl. Punjab 360. 1924; Riedl in Rechner, Fl. Iranica 48: 6. 1967.

Cordia angustifolia Roxb. Fl. Indica, ed. Carey & Wall. 2: 338. 1824, non Roem. & Schult.

Cordia subopposita DC. Prodr. 9: 480. 1845.

TYPE: Arabia: Hadie, *Forsskål*, s.n. (as *Cornus sanguinea* Forssk. C.)

ICON.: Brandis, Indian Trees fig. 172. 1921; Wight, Icon. Pl. Indiae Orient. 4: t.1379. 1848, under *C. rothii* Roem. & Schult.

A large or small tree, twigs glabrous or nearly so. Leaves subopposite, 5-10 cm. long, 2-2.5 cm. broad, oblanceolate oblong, entire or undulate, apices usually rounded, rough and glabrous above when mature, more or less pubescent below; petioles 8-13 mm. long. Inflorescence short paniculate-corymbose, subtomentose; peduncles 1.2-2.5 cm. long, puberulous to subtomentose. Flowers 5 mm. across, white, usually tetramerous, pedicel short, slender. Calyx \pm 5 mm. long, minutely pubescent externally, silky within, campanulate-tubular, lobes small, obtuse. Corolla tube equalling the calyx lobes, corolla lobes short, \pm 3 mm. long, obtuse, reflexed, fila-

ments glabrous. Drupe usually 1-seeded, about 12 mm. long, ovoid, mucronate, striate, yellow or reddish brown when ripe.

DISTRIBUTION: Pakistan, India, Ceylon, Arabia, and North Africa.

West Pakistan: JHELUM DIST.: Langarpur, *R. R. Stewart 544* (K, RAW). KARACHI DIST.: Jemadar ka Landa near Karachi, *Stocks 427* (K); Karachi, *Jafri s.n.* (KAU). LAHORE DIST.: Lahore, *Thomson s.n.* (K), *R. R. Stewart s.n.* (K). Reported from Sind and Baluchistan.

Kashmir: Reported from Jammu.

Forsskål called the plant collected by him from Beit el Fakih and Hadie by its local name *Cornus gharaf*. This name has sometimes been rejected by many authors, most recently by Meikle (*Israel Jour. Bot.* 18: 141, 142, 1969), as a *nomen nudum* because no description was given on page xci, xciii, xcv, xcvi, and xcix of Forsskål *Fl. Aegypt.-Arab.* 1775, but on page xcix there is a clear reference to the description under *Cornus sanguinea*.²

The epithet *sanguinea* was not available in the genus *Cornus* but could have been used by Ascherson for his new combination under *Cordia* instead of *gharaf*. However, since the name *gharaf* was selected by him, used later by many authors, and of course has no problems of priority, it should be accepted.

Cordia gharaf is said (Parker *l.c.*) to be wild in Jaipur State on the Delhi Ridge and probably also in the hills of southeast Punjab, and planted elsewhere.

2. *C. dichotoma* Forster, Prodr. 18. 1786.

Varrenia sinensis Lour. Pl. Cochinch. 138. 1790.

Cordia indica Lam. Encycl. Méth. Bot. 1: 422. 1791.

Cordia lourieri Roem. & Schult. Syst. Veg. 4: 466. 1819.

C. suaveolens Blume, Bijdr. Natuurk. Wetens. 14: 843. 1826.

C. brownii DC. Prodr. 9: 499. 1845.

C. ixiocarpa F. Muell. Frag. Phytogr. Austral. 1: 59. 1856.

C. lowriana Brandis, Indian Trees 479. 1906.

TYPE: "New Caledonia" without citation of collector's name (BM).

Trees 3–10 m. tall. Leaves elliptic to ovate or obovate, usually 8–12 cm. long, 4–8 cm. broad, apices obtuse, base rounded to acute, margins entire to rarely sinuate above the middle, upper surface sparingly puberulent, glabrescent or at times dotted, lower surface paler, puberulent, usually glabrescent; petioles slender, 2–4 cm. long. Inflorescence cymose, dichotomous, bractless, loosely branched; peduncles 1–3 cm. long. Flowers of two sorts, male and hermaphrodite, produced, apparently, on separate trees. Male flowers shorter than the hermaphrodite, similar in form or at times with somewhat expanded corolla tube; filaments 3.5–4.7 mm. long, spar-

² On page xcix we find "Cornus gharaf. C. II. 10. In cephalagia." This refers to Centuria II, species no. 10 [on p. 33], which is *Cornus sanguinea*. Therefore, there is no doubt about what is meant by *Cornus gharaf* and *C. sanguinea*.

ingly hairy below the middle; anthers 2–2.8 mm. long; ovary abortive, globose, glabrous, bearing a minute terminal papilla representing the undeveloped style. Hermaphrodite flowers with calyx 5–6 mm. long, oblong in bud, not striate, campanulate, 4–6 mm. in diameter at summit, base rounded, sessile, lobes recurved, unequal, somewhat triangular; corolla 8–10 mm. long, lobes recurving, 5–6 mm. long, 2–2.5 mm. wide, tube 3–5 mm. long, usually shorter than the lobes, hairy only below the stamen-attachment; filaments 1–2 mm. long, sparingly hairy below the middle; styles with basal column 1–1.5 mm. long, the first branch about 1 mm. long, the ultimate stigmatiferous branches 3–6 mm. long, flattened, broadened, and not usually minutely lobulate above the middle. Drupe with viscous mesocarp, globose, 10–15 mm. in diameter, yellow or somewhat orange or reddish, supported by an accrescent indurate saucer-shaped calyx, 8–12 mm. in diameter.

DISTRIBUTION: Pakistan, Kashmir, India, southern China, Formosa, Hainan, Indochina, New Caledonia, and northeastern Australia.

West Pakistan: Reported from Karachi, Sind, Lower Baluchistan, Salt Range, Multan, and Rawalpindi, both wild and cultivated.

Kashmir: Reported from Mirpur, Billawar, and Jammu, both wild and cultivated.

The thinner more elongate, frequently acuminate leaves of *Cordia dichotoma* are usually once and a half to twice as long as broad, they are never subcordate at base as is frequently the case with the leaves of *C. myxa* and relatives. *Cordia myxa*, *C. obliqua* and their allies differ from *C. dichotoma* in their rounded thickish nonacuminate leaves, as well as in their coarser flowers, and very much larger drupes. Typically their leaves are less than once and a half as long as broad, frequently they are about as broad as long.

3. ***C. obliqua*** Willd. Phytogr. 1(4): t. 4, fig. 1. 1794. Willd., Linn. Sp. Pl. 1: 1072. 1797; DC. Prodr. 9: 479. 1845; C. B. Clarke in Hook. f. Fl. Brit. India 4: 137. 1883; Parker, Forest Fl. Punjab 359. 1924; Kashyap, Lahore Dist. Fl. 167. 1936.

C. latifolia Roxb. Fl. Indica, ed. Carey & Wall. 2: 330. 1824; Brandis, Forest Fl. India 336. 1874, *pro parte*.

TYPE: Habitat in Malabar, Klein, s.n. (B).

ICON.: Willd. l.c. t. 4, fig. 1. 1794.

A medium-sized deciduous tree; bark with numerous shallow longitudinal fissures; branchlets glabrous or more or less brown-tomentose when young. Leaves 7–13 cm. long, 6–12 cm. broad, variable, orbicular, broadly ovate, elliptic or obovate, obtuse or more or less abruptly acuminate, base rounded, rarely cuneate, margins entire or slightly sinuate-dentate, glabrous or nearly so above but rather harsh, without white discs, more or

less pubescent, especially in the axils of the nerves beneath, basal nerves 3 rarely 5; petioles 17–35 mm. long. Inflorescence large, lax, of terminal or axillary pedunculate cymes; peduncles 2.5–5 mm. long. Flowers white, 5–10 mm. across, polygamous; pedicels short; buds pyriform. Calyx about 2.5 mm. long, glabrous externally or scarcely villous at the margins, pubescent within, splitting irregularly on the opening of the flower. Corolla tube as long as the calyx; lobes 5, as long as the tube, oblong-obtuse, recurved. Filaments hairy at base. Drupe ovoid, 12–25 mm. long, apiculate, yellowish brown, pink or nearly black when ripe, shining, minutely rugose, supported by the saucer-shaped, faintly striate calyx; pulp nearly transparent, viscid, sweetish, edible.

DISTRIBUTION: Pakistan, India, Ceylon (and North Africa ?).

3a. *Var. obliqua*.

Adult leaves glabrous beneath; calyx glabrous externally, scarcely villous on the margins.

West Pakistan: Reported from Rawalpindi and Salt Range, often cultivated.

3b. *Var. tomentosa* (Wall.) Kazmi, comb. nov.

C. tomentosa Wall. in Roxb. Fl. Indica, ed. Carey & Wall. 2: 339. 1824.

C. wallichii G. Don, Gen. Syst. 4: 379. 1838; DC. Prodr. 9: 479. 1845; Cooke, Fl. Bombay Presidency 2: 200. 1908; Brandis, Indian Trees 479. 1921.

C. obliqua var. *wallichii* (G. Don) C. B. Clarke in Hook. f. Fl. Brit. India 4: 137. 1883.

TYPE: India in Dr. Heyne's collection, under *C. obliqua* var. (κ).

Adult leaves densely stellate fulvous or white tomentose beneath; calyx glabrous externally.

West Pakistan: Lahore Dist.: Lahore, *Kazmi 2469* (PES).

C. myxa sensu C. B. Clarke in Hook. f. Fl. Brit. India 4: 136. 1883, is a misidentification.

4. *C. macleodii* (Griff.) Hook. f. & Thoms. Jour. Linn. Soc. Bot. 2: 128. 1858; C. B. Clarke in Hook. f. Fl. Brit. India 4: 139. 1883; Brandis, Forest Fl. India 337. t. 41. 1874, Indian Trees 479. 1921; Cooke, Fl. Bombay Presidency 2: 200. 1908; Parker, Forest Fl. Punjab 359. 1924.

Hemigymnia macleodii Griff. Calcutta Jour. Nat. Hist. 3: 363. 1843.

TYPE: Sylvae Jubbulpore vicinae, plerumque cum *Tectona consociata*, Herb. Griff. (κ).

ICON.: Brandis, l.c. t. 41. 1874.

A small tree with smooth gray bark, twigs clothed with dense white pubescence. Leaves alternate or sometimes almost subopposite, 7–18 cm. long, 5–15 cm. broad, orbicular or broadly ovate, obtuse, base cordate or

rounded, margins sinuate, firm and hard when mature, glabrous above with impressed nerves and raised discs, clothed beneath with short, dense, gray tomentum, basal nerves usually 3–5 or the nerves subbasal or sometimes the lowest pair of the secondary nerves arising at some distance from the base; petioles 2.5–5 cm. long, stout, tomentose. Inflorescence of terminal and axillary paniculate cymes, tomentose. Flowers white, 12 mm. across, subsessile, polygamous; buds obovoid. Calyx 6–8 mm. long, thick, ribbed, densely tomentose externally, glabrous within, lobes usually 6, as long or longer than the tube, spreading, spatulate-oblong, obtuse, veined. Filaments hairy at the base. Drupe 12–18 mm. long, ovoid, acute, supported by the cup-shaped, slightly ribbed calyx, not edible.

DISTRIBUTION: Pakistan and India.

West Pakistan: SIALKOT DIST.: Sialkot Proper (seeds collected from Sialkot and grown at Dehra Dun), *Ishtiaq Hussain s.n.* (GH). Cultivated eastwards to Rawalpindi.

5. *C. vestita* (DC.) Hook. f. & Thoms. Jour. Linn. Soc. Bot. 2: 128. 1858; Brandis, Forest Fl. India 338. 1874, Indian Trees 480. 1921; C. B. Clarke in Hook. f. Fl. Brit. India 4: 139. 1883; Parker, Forest Fl. Punjab 38. 1924.

C. incana Royle, Illus. Bot. Himal. Mount. 1: 306. 1839, *nomen nudum*.
Gynaion vestitum DC. Prodr. 9: 468. 1845.

TYPE: In Himalaya occidentali tropica, Garhwal ad Pau, alt. 3,000–4,000 ped. *Edgeworth s.n.* (G–DC).

A small deciduous tree, bark greenish gray, exfoliating in large woody flakes, branchlets densely gray-tomentose when young. Leaves alternate, 7.5–15 cm. long, 6–13 cm. broad, sometimes larger, orbicular, broadly ovate or obovate, apices rounded or acuminate, base rounded or cuneate near the petioles, margins undulate, scabrous above with rather prominent white discs, tomentose beneath until mature, basal nerves 3–5, arising usually from a little above the base; petioles 2–4 cm. long, stout. Inflorescence of dense compound cymes, male in unilateral racemes; peduncles tomentose. Flowers yellowish white, 12 mm. across, polygamous; pedicels tomentose; buds pyriform. Calyx 10 mm. long, pubescent, more or less ribbed outside, slightly hairy near the base inside, lobes 5. Corolla tube equalling the calyx, very hairy within, lobes 5, slightly shorter than the tube, spreading, obovate, crenulate, notched at the tips. Filaments hairy at base. Drupe 1.7 cm. long, ellipsoid, acute, supported by the accrescent calyx, which is campanulate, 12 mm. long, thick and strongly ribbed; pulp gelatinous, edible.

DISTRIBUTION: Pakistan and India.

West Pakistan: SIALKOT DIST.: Mt. Tilla, *Aitchison 45* (K). Salt Range and Sub-Himalayan tracts, not common, often cultivated.

Kashmir: Reported from Mirpur and Jammu.

6. *C. myxa* L. Sp. Pl. 190. 1753; DC. Prodr. 9: 479. 1845; Cooke, Fl. Bombay Presidency 2: 200. 1908; Brandis, Forest Fl. India 366. 1874, excluding synonyms.

TYPE: "Habitat in Aegypto, Malabaria" *Herb. No. 253.1* (LINN).

ICON.: Wight, Illustr. Indian Bot. 2: t. 169. 1841.

A moderate-sized deciduous tree reaching about 13 m., or a large shrub; bark dark, rough, fissured; branchlets usually glabrous. Leaves alternate, broadly ovate to suborbicular, obtuse, ca. 5 cm. long and 4 cm. broad, entire or with slightly uneven undulate margins, upper surface glabrous, the lower pubescent. Inflorescence paniculate or paniculate-corymbose, usually subglabrous. Calyx 3–4 mm. long, campanulate-tubular, usually pubescent, lobes short. Corolla tube hairy inside, lobes 5, short, 2.5–3 mm. long. Fruits up to 18 mm. long, subacute, ovate.

DISTRIBUTION: Tropical Asia, Pakistan, India, Iran, and Australia.

West Pakistan: BALUCHISTAN: Shah Bilaweel, *Stocks s.n.* (K). Reported from Nasirabad, Rindli and Drabbi in Baluchistan.

2. *Ehretia* L. Syst. ed. 10. 936. 1759

Traxilum Raf. Sylva Telluriana 42. 1838.

TYPE SPECIES: *E. linifolia* L.

Trees or shrubs. Leaves small to large, usually distinctly petiolate, margins entire or serrate. Corolla white or yellowish, tube campanulate or elongate, lobes spreading or recurved; filaments elongate, anthers usually exerted; style terminal on the ovary, cleft above the middle, stigmas 2, small, capitate or elongate. Drupe subglobose, mostly yellow, orange or reddish, glabrous; endocarp at maturity breaking apart into either 2-seeded or 1-seeded pyrenes.

Species 50, all tropical, principally in the Old World, except 3 species in America.

KEY TO THE SPECIES

- a. Leaves serrate. 1. *E. serrata*.
 a. Leaves entire.
 b. Leaves not exceeding 7.5 cm. in length, hairy beneath when mature; shrubby plants. 2. *E. obtusifolia*.
 b. Leaves usually larger, reaching up to 12 cm. in length, glabrous beneath when mature; small trees. 3. *E. laevis*.

1. *E. serrata* Roxb. (Hort. Bengal. 17. 1814, *nomen nudum*) Fl. Indica, ed. Carey & Wall. 2: 340. 1824, ed. Carey 1: 596. 1832; DC. Prodr. 9: 503. 1845, excluding vars.; Brandis, Forest Fl. India 339. 1874.

E. acuminata R. Br. var. *serrata* (Roxb.) I. M. Johnston, Jour. Arnold Arb. 32: 23. 1951.

TYPE: "in Bengalo orientali, Silhet etc." *Roxburgh s.n.* (CAL).

ICON.: Lindl. Bot. Reg. 13: t. 1097. 1827; Wight, Illustr. Indian Bot. 2: t. 170. 1841.

A medium-sized deciduous tree with rough not deeply fissured gray bark, twigs usually brownish-pubescent when quite young. Leaves 8–15(–20) cm. long, (3–)4–7(–10) cm. broad, usually lanceolate, sometimes elliptic-oblong, usually slenderly acuminate, margins finely and regularly serrate, the teeth ascending, usually with slender, prolonged, thickened, strict or incurved tips, base narrowed rarely rounded, midrib sparsely adpressed-hairy above, nerves slightly hairy in the axils beneath, otherwise glabrous; petioles 12–30 mm. long. Inflorescence of large terminal puberulous panicles with the lower branches axillary, 10–20 cm. long, 5–13 cm. broad. Flowers white, fragrant, sessile, 2.5 mm. across. Calyx sessile, 1.5–2 mm. long, lobes 0.8 mm. long, rounded, ciliate. Corolla 3–4 mm. long, nearly twice as long as the calyx, lobes 2–3 mm. long, about 1.5 mm. broad, blunt, spreading, tube about 1 mm. long. Filaments 2–3 mm. long. Style bifid, stigmas small, capitate. Drupe globose, nearly black when ripe, 3.5 mm. in diameter; pyrenes 2, each 2-celled, cells 1-seeded.

DISTRIBUTION: Assam to Kashmir and West Pakistan.

West Pakistan: HAZARA DIST.: Balakot, *Inayat 21993* (K); Haripur, *Kazmi 2474* (PES); Maksud near Haripur, 660 m., *R. R. Stewart 12561* (GH, K, RAW); Abbottabad, *Dickason s.n.* (MICH). RAWALPINDI DIST.: Rawalpindi-Murree Road, *R. R. Stewart 6120* (A). SWAT STATE: Saidu Sharif, *Kazmi 2464* (PES); Margzar, *R. R. Stewart 24306* (K, RAW), *Kazmi s.n.* (PES).

Kashmir: POONCH DIST.: Nawal Nadi, *R. R. Stewart s.n.* (K, RAW). Miscellaneous: Kashmir, *Falconer Herb. East Ind. Co. s.n.* (GH, K); Himal. Bor. Occid. *Thomson*, Hook. f. & Thoms. *Herb. Ind. Orient. s.n.* (GH, K). Reported from Jhelum Valley Road, Kishtwar, Udhampur and Jammu etc.

2. *E. obtusifolia* Hochst. ex DC. Prodr. 9: 507. 1845; C. B. Clarke in Hook. f. Fl. Brit. India 4: 142. 1883; Riedl in Rechinger, Fl. Iranica 48: 7. 1967.

E. obovata R. Br. in Salt. Voyage 64. 1814, *nomen nudum*; DC. Prodr. 9: 507. 1845, *in synon.*

TYPE: Abyssinia Distr. Medschara, *Schimper 2652* (B).

A deciduous shrub, young twigs clothed with brown pubescence and gray spreading hairs. Leaves 3–8 cm. long, 2–4 cm. broad, sometimes longer, variable in shape, usually obovate, rounded or retuse at the apices; covered thinly on both surfaces with usually scattered, sometimes dense, adpressed gray hairs, persistently hairy beneath; entire; petioles 5–18 mm. long. Inflorescence when young of close paniculate cymes, later lax and laterally corymbose, apparently terminal. Flowers pale bluish-white, 7–13 mm. across. Calyx 2.5 mm. long, externally hairy, lobes ovate-oblong, acute or subacute, ciliate. Corolla 6–8 mm. long, tube exceeding the

calyx, lobes about as long as the tube, blunt, spreading. Drupe globose to depressed globose 6 mm. in diameter; pyrenes usually 4.

DISTRIBUTION: Pakistan, Kashmir, India, and Abyssinia.

West Pakistan: ATTOCK DIST.: Campbellpur, Kala Chitta hills, 600 m., *R. R. Stewart 13620* (GH). GUJRAT DIST.: Pabbi hills, *R. N. Parker 3327* (A). HAZARA DIST.: Mirpur, *Kazmi 847* (PES). KOHAT DIST.: Thal, *Aitchison 515, 529* (GH). LAHORE DIST.: Changa Manga Forests, *Kazmi 2498* (PES). QUETTA DIST.: Harnai, *Lace s.n.* (K). RAWALPINDI DIST.: Murree Road, *R. R. Stewart 1671* (A); near Rawalpindi, *R. R. Stewart 13777* (GH). Miscellaneous: Shah Belaweel, *Stocks 539* (K). Reported from Salt Range, Kalat: Pab, Wahir and Las Bela, and Sind.

Kashmir: Kotli beyond Mirpur, *A. Rashid* in *R. R. Stewart 27243* (BM).

3. *E. laevis* Roxb. Coromandel Pl. 1: 42. *t. 56*. 1795, Fl. Indica ed. Carey & Wall. 2: 341. 1824, ed. Carey 1: 597, 1832; C. B. Clarke in Hook. f. Fl. Brit. India 4: 141. 1883; Brandis, Forest Fl. India 340. 1874, Indian Trees 481. 1921; Parker, Forest Fl. Punjab 362. 1924; Kashyap, Lahore Dist. Fl. 167. 1936; Riedl in Rechinger, Fl. Iranica 48: 7. 1967.

E. affinis Wall. Cat. No. 900. 1829, *nomen nudum*.

E. dichotoma Rottl. in Wall. Cat. No. 904. 1829.

E. punctata Roth, Nov. Pl. Sp. Indiae Orient. 126. 1821.

Beurreria laevis G. Don, Gen. Syst. 4: 390. 1838.

Beurreria punctata G. Don, Gen. Syst. 4: 390. 1838.

E. floribunda Benth. in Royle, Illustr. Bot. Himal. Mount. 1: 306. 1839.

E. laevis var. *floribunda* (Benth.) Brandis, Forest Fl. India 340. 1874; C. B. Clarke in Hook. f. Fl. Brit. India 4: 143. 1883.

E. laevis var. *platyphylla* Merrill, Lingnan Sci. Jour. 14: 55. 1935.

TYPE: "Circar Mountains" without citation of collector's name (CAL?).

ICON.: Roxb. l. c. *t. 56*. 1795; Wight, Icon. Pl. Indiae Orient. 4: *t. 1382*. 1848.

A small or large deciduous shrub to 10 m. tall tree, bark smooth gray, twigs glabrous or nearly so. Leaves ovate-elliptic or obovate or even suborbicular, 7–12 cm. long, 5–11 cm. broad, rounded or angled at bases and apices, when mature somewhat lustrous above, when young minutely glandular pubescent below, but except for some hairs in the vein axils becoming glabrous at maturity; petioles 1–2.5 cm. long. Inflorescence appearing just before leaf renewal, terminal and axillary, loosely dichotomous, with few bracts on the primary axis, otherwise naked, ultimate branches bearing sessile flowers unilaterally in two crowded ranks, hence somewhat scorpioid, particularly just before anthesis. Flowers white, sessile or subsessile. Calyx 1–2 mm. long, tawny-tomentose. Corolla 2.5–3.5 mm. long, subrotate, not conspicuous, tube open, 0.7–1.5 mm. long; lobes 2–2.5 mm. long, recurving. Style 2–3 mm. long, lobes as much as 1 mm. long. Drupe yellow or orange, 3–4 mm. diameter, endocarp rugose, breaking up at maturity into 4 single-seeded parts.

DISTRIBUTION: Iran, Pakistan, Kashmir, India, Burma, Hainan, Polynesia, Indochina, and Australia.

West Pakistan: ATTOCK DIST.: Kala Chitta hills, *R. R. Stewart 13608* (GH). HAZARA DIST.: Balakot, *Kazmi 2467* (PES). JHELUM DIST.: Mount. Tilla, *Kabir 20420* (RAW). LAHORE DIST.: Shahadra near Lahore, *R. R. Stewart 15375* (GH). PESHAWAR DIST.: near Peshawar, *R. R. Stewart 300b* (A). QUETTA DIST.: Torkhan Pass, above Harnai, *Kazmi 2488* (PES). Miscellaneous: Shah Bilaweel, *Stocks 607* (K).

Kashmir: Reported from Jhelum Valley, Mirpur, and Jammu.

3. *Coldenia* L. Sp. Pl. 125. 1753; Gen. Pl. ed. 5. 61. 1754.

TYPE SPECIES: *C. procumbens* L.

Usually branched, diffuse or prostrate herbs. Leaves small, crisped. Flowers white or yellow, sessile or nearly so. Calyx 4–5-partite, segments linear or lanceolate. Corolla tube short, rather broad, naked or with 4–5 appendages within, lobes 4–5, spreading, imbricate in bud. Stamens 4–5, inserted on the corolla tube, included; filaments short; anthers ovate. Ovary ovoid, slightly 4-lobed, 2-celled with 2 ovules or 4-celled with 1 ovule in each cell; styles 2, distinct, cohering from the base to the middle but easily separable, terminal; stigmas capitate. Drupe almost dry, of 4 subconnate, 1-seeded pyrenes. Seeds exalbuminous or with scanty albumen; cotyledons flat, broad; radical short, straight, incurved or incumbent on the cotyledons.

Species about 11, all American except the following, which is widely dispersed throughout the warmer regions.

C. procumbens L. Sp. Pl. 125. 1753; Aitch. Cat. Pl. Punjab & Sind 93. 1869; C. B. Clarke in Hook. f. Fl. Brit. India 4: 144. 1883; Cooke, Fl. Bombay Presidency 2: 205. 1908.

TYPE: "Habitat in India" *Herb. No. 174. 1.* (LINN).

A procumbent herb, usually lying quite flat on the ground, stems reaching up to 45 cm. in length, shaggy with white hairs, branches often numerous, young parts silky with white hairs. Leaves crisped, 12–38 mm. long, 6–18 mm. broad, obovate-oblong, rounded at the apices, coarsely serrate or subpinnatifid, very hairy on both surfaces, base tapering; petioles shaggy, 3–9 mm. long. Flowers pale yellow, solitary, axillary, nearly sessile. Calyx divided to the base or nearly so, very hairy, segments 4, ovate, acute, ciliate, 2.5 mm. long. Corolla naked within, 2.5 mm. long. Stamens 4, scarcely higher than the corolla tube. Fruits dry 4-lobed pyramids, about 3 mm. long, 4 mm. broad at the widest part, grooved on two and ribbed on the other two sides, with a sharp central double beak, hairy, ultimately separating into 1-celled beaked pyrenes.

DISTRIBUTION: Pakistan, India, Ceylon, and tropics.

West Pakistan: Sind, *Stocks 549* (K).

4. *Heliotropium* L. Sp. Pl. 130. 1753; Gen. Pl. ed. 5, 63. 1754.TYPE SPECIES: *H. europaeum* L.

Annual or perennial herbs or undershrubs, villous or scabrous. Leaves alternate. Spikes terminal, rarely axillary, dichotomous, branches short or long, scorpioid. Flowers usually white, light bluish, or rarely yellow, bracteate, ebracteate, or bracts much reduced. Calyx 5-partite or -lobed, segments lanceolate or linear, free, rarely coherent at the base. Corolla tubular, cylindrical or infundibuliform, usually hairy outside, sometimes also inside, lobes 5, plicate, subvalvate or imbricate, inflexed or patent, linear to roundish. Stamens 5, anthers sessile or with short filaments, inserted on the corolla tube, included, ovate to linear-lanceolate, rarely apiculate. Ovary completely or imperfectly 4-celled, 4-ovuled; style terminal, short or long, ending in a stigmatic disc, with a short or long, more or less conical appendage. Fruits dry, 2-4-lobed, of 4 or less nutlets. Seeds straight or curved, albumen small or none.

Species 275, in tropical and temperate zones of both hemispheres.

KEY TO THE SPECIES

- a. Prostrate herbs; calyx divided up to 1/4 of its length, lobes short. Fruit enclosed by calyx. 24. *H. supinum*.
- a. Prostrate, decumbent or erect herbs or undershrubs; calyx divided nearly to the base, lobes free, long. Fruit not enclosed by the calyx.
 - b. Plants completely glabrous. 23. *H. curassavicum*.
 - b. Plants variously hairy.
 - c. Stigma with 2 linear, filiform, recurved arms, exerted from the corolla. 7. *H. ophioglossum*.
 - c. Stigma short, minutely lobed or not, always included in corolla.
 - d. Inflorescence partly or fully bracteate, bracts sometimes much reduced.
 - e. Stigma subcapitate, stigmatic ring fleshy and thick; corolla 1.5-2.5 mm. long, internally sparsely pilose from 0.5 mm. above the corolla base. 1. *H. rarifolium*.
 - e. Stigma elongate conic, stigmatic ring not fleshy, thin; corolla 2.5-4 mm. long, internally slightly or densely hairy only at the throat.
 - f. Plants decumbent or prostrate; leaves lanceolate or elliptic; flowers sessile, closely set on the inflorescence. 3. *H. marifolium*.
 - f. Plants usually erect, sometimes decumbent; leaves linear to linear-lanceolate; flowers usually subsessile to pedicellate, rarely sessile; flowers distantly set on the inflorescence.
 - g. Leaves linear, up to 45 mm. long, up to 3 mm. broad; inflorescence bracteate throughout. . . 4. *H. zeylanicum*.
 - g. Leaves linear-lanceolate not exceeding 25 mm. in length, 3 mm. in width; lower flowers of the inflorescence evidently bracteate, in the upper flowers bracts much reduced or sometimes absent. 2. *H. strigosum*.

- d. Inflorescence ebracteate.
 - h. Corolla variously hairy within.
 - i. Corolla inside clearly with two hairy zones separated by a glabrous zone in between. 17. *H. baluchistanicum*.
 - i. Corolla hairy inside, hairs neither in zones nor separated by any glabrous zone.
 - j. Corolla 2.5–3 mm. long; stigma sessile.
 - k. Inflorescence of closely set flowers; calyx lobes unequal; leaf bases obtuse to acute; anthers 0.5–0.6 mm. long; stigma 0.3–0.4 mm. long. 22. *H. ovalifolium*.
 - k. Inflorescence of distantly set flowers; calyx lobes equal; leaf bases roundish or sometimes truncate; anthers 1 mm. long; stigma 0.9–1 mm. long. 16. *H. remotiflorum*.
 - j. Corolla 4–8 mm. long; stigma subsessile or with style up to 0.7 mm. long.
 - l. Corolla 4–5 mm. long, lobes sublinear, plicate, inflexed into the corolla tube; stigma elongate-conical. 11. *H. gillianum*.
 - l. Corolla 5–8 mm. long, lobes ovate or roundish, imbricate, patent; stigma compressed-conical.
 - m. Leaves lanceolate to ovate-lanceolate with short petioles, loosely covered with short, more or less erect hairs arising from tubercles, lower surface sometimes glabrous; flowers 3–7, loosely arranged; corolla uniformly hairy inside. 14. *H. cabulicum*.
 - m. Leaves ovate to ovate-oblong with long petioles densely covered with long hairs apparently not arising from tubercles; flowers 7–20, closely arranged; corolla thickly hairy inside above the anthers and below the corolla lobes, and thinly so in between. 18. *H. biannulatum*.
 - h. Corolla glabrous within.
 - n. Plants annual.
 - o. Plants grayish-white; inflorescence up to 12 cm. long with loose uniseriate flowers; calyx deciduous. 19. *H. calcareum*.
 - o. Plants green to grayish-green; inflorescence 2–5(–8) cm. long with closely set biseriate flowers; calyx persistent.
 - p. Nutlets pubescent to often densely tomentose. 20. *H. europaeum*.
 - p. Nutlets glabrous, slightly reticulate-rugose or indistinctly verruculose. 21. *H. ellipticum*.
 - n. Plants perennial.
 - q. Corolla lobes broad, oblong, ovate or roundish, subvalvate or imbricate.
 - r. Leaves ovate, oblong-ovate or oblong-lanceolate; calyx 3.5–4 mm. long; corolla more or less 5 mm. long; nutlets free from the beginning. 15. *H. ullophyllum*.

- r. Leaves lanceolate to linear-lanceolate; calyx 1.75–2.5 mm. long; corolla 3–3.5 mm. long; nutlets 4, in 2 pairs or later free.
 - s. Nutlets not margined. 6. *H. crispum*.
 - s. Nutlets margined. 8. *H. bacciferum*.
- q. Corolla lobes narrow, usually acute, plicate or subvalvate, inflexed in corolla tube when young, later more or less inflexed, suberect, or patent.
- t. Leaves many times longer than broad, corolla lobes inflexed when young, later patent, caudate-acuminate. 5. *H. subulatum*.
- t. Leaves not much longer than broad; corolla lobes inflexed when young, later suberect or erect, not patent, not caudate-acuminate.
- u. Anther connectives produced.
 - v. Leaves 15–25 mm. long, 15–20 mm. broad, ovate, orbicular or sometimes subcordate; corolla lobes 1 mm. long, linear. . 13. *H. aucheri*.
 - v. Leaves 3–12 mm. long and broad, ovate, rotund or truncate at base; corolla lobes 0.5 mm. long, narrowly triangular. 12. *H. lamondiae*.
- u. Anther connectives not produced.
 - w. Corolla 3–4 mm. long, lobes 0.7–1 mm. long, sinuses narrow, entire; anthers 1.2–1.5 mm. long, attached 1 mm. above the corolla base; style shorter than stigma. . 9. *H. dasycarpum*.
 - w. Corolla 4.5–5.5 mm. long, lobes 0.9–1.2 mm. long, sinuses broad, lobed or slightly dentate; anthers 1.2–2 mm. long, attached 1.8–2 mm. above the corolla base; style equalling the stigma. 10. *H. brahuicum*.

1. *H. rariflorum* Stocks in Hook. Jour. Bot. 4: 174. 1852; Boiss. Fl. Orient. 4: 144. 1875; C. B. Clarke in Hook. f. Fl. Brit. India 4: 152. 1883; Cooke, Fl. Bombay Presidency 2: 209. 1908; Burkill, Fl. Pl. Baluchistan 50. 1908; Riedl in Rechinger, Fl. Iranica 48: 15. 1967.

TYPE: Baluchistan inferior (Karachi, Jemadar ka Landa), *Stocks* 492 (K).

ICON.: Biol. Skr. 13(4): fig. 150. 1963.

Perennial undershrub, erect, 15–45 cm. tall. Stem and branches rigid, when young grayish-green, covered with short appressed hairs; brown when old, sometimes glabrous, bark peeling. Leaves linear-lanceolate, sessile, or short-petiolate, 20–35 mm. long, 3–5 mm. broad, subacute, entire, sometimes more or less revolute at margins, covered on both surfaces with short, stiff, appressed hairs. Inflorescence of slender, terminal and extra-axillary, bracteate spikes 2.5–7.5 cm. long; bracts sessile or subsessile 3–4 mm. long. Flowers white, sessile, distant. Calyx deeply 5-

lobed, lobes 1.5 mm. long, 0.6 mm. broad, lanceolate, obtuse to subacute, hairy externally and at the margins, more or less glabrous internally. Corolla 1.5–2(–2.5) mm. long, cylindrical-campanulate, externally hirsute, internally sparsely pilose from 0.5 mm. above the base, lobes 5, short, broadly ovate. Anthers 0.6 mm. long, ovate, inserted at or little above the middle of the corolla tube. Stigma depressed capitate, glabrous. Fruits 4-lobed, about 2.5 mm. across; nutlets 4, covered with appressed short hairs.

DISTRIBUTION: West Pakistan, Afghanistan, India, East and Southeast Africa.

West Pakistan: KALAT DIST.: Rar Kaur, southwest of Kalat, 1200 m., *Hotson* 298 (GH). KARACHI DIST.: Karachi proper, Jemadar ka Landa, *Stocks* 492 (K); Dumloti, *Tasnif* in *Kazmi* 2459 (PES); North Nazimabad, Mangu-peer Road, *Jafri* 3602 (E); Jangshahi, stony hillock, *Jafri* 1576 (E). MAKRAN DIST.: Near Pasni, wind-blown sand deposits in foothills, *G. Popov* 27a (BM). THATTA DIST.: Thatta, *Bhola Puran* in *Cooke s.n.* (K).

2. *H. strigosum* Willd., Linn. Sp. Pl. 1: 743. 1798; DC. Prodr. 9: 546. 1845; Boiss. Fl. Orient. 4: 143. 1875; C. B. Clarke in Hook. f. Fl. Brit. India 4: 151. 1883; Burkill, Fl. Pl. Baluchistan 50. 1908; Riedl in Rechinger, Fl. Iranica 48: 15. 1967.

TYPE: "Habitat in Guinea" without citation of collector's name (B).

Perennial or rarely annual, prostrate, procumbent or erect, up to 30 cm. tall herbs. Stems tufted or intricately branched, covered with short, straight, stiff, appressed, white hairs. Leaves linear-lanceolate, 6–20(–25) mm. long, up to 2.5(–3) mm. broad, entire, subacute, sessile or the lower ones very short petiolate, clothed on both surfaces with short, stiff, white, appressed hairs up to 0.5 mm. long. Inflorescence 2.5–7.5 cm., in fruit to 15 cm. long, of solitary or geminate, bracteate spikes; bracts in the lower part up to 3 mm. long, above much reduced or, rarely, absent. Flowers white or pale blue with a tiny yellow eye; lower flowers pedicellate, pedicels 1–2 mm. long, upper subsessile to sessile. Calyx deeply 5-lobed, lobes up to 3 mm. long, lanceolate, cuneate, strigose externally. Corolla 3 mm. long, tubular or funnelform, strigose externally, the throat minutely and sparsely glandular and puberulent at the summit internally, lobes oblong or very short and broad, somewhat involute in bud. Anthers 0.75 mm. long, ovate-lanceolate, tips thickened and coherent when young; filaments 0.5 mm. long, inserted 0.5 mm. above the corolla base. Style distinct, 0.4 mm. long; stigma 0.5 mm. long, with a distinct stigmatic ring about 0.3 mm. in diameter and superimposed on a narrowly conic sterile appendage. Fruits rounded or lobed, depressed or globose, covered with closely set, appressed hairs; nutlets 4, about 1 mm. high.

DISTRIBUTION OF SPECIES: Africa, Arabia, Afghanistan, Pakistan, Kashmir, India, Ceylon, Burma, Siam, Hainan, Fukian, Macao, and Hongkong.

2a. Subsp. *strigosum*.

Usually procumbent to erect; stems tufted; stem, branches and leaves covered with closely set trichomes giving the whole plant a grayish-white aspect. Leaves 15–20(–25) mm. long. Fruits 4-lobed, depressed at the top towards the style.

DISTRIBUTION OF SUBSP.: Africa, Arabia, West Pakistan, India, and Ceylon, probably introduced in Australia.

West Pakistan: ATTOCK DIST.: Between Hazro and Saidan, ca. 2 miles north of Grand Trunk Rd., dry sandy roadsides, *Burttt 686* (E). BANNU DIST.: In collibus arenosis Pezu, inter Dera Ismail Khan et Bannu, 400 m. *Rechinger 30035* (G, W). DADU DIST.: Karachi to Dadu, ca. 10–15 km. south of Sehwan, outermost limestone outcrop, *Lamond 846* (E, G); *Rechinger 28718* (G, W). DERA ISMAIL KHAN DIST.: Sulaiman Range, Fort Sandeman to D. I. Khan, ca. 100 km. from Fort Sandeman, between Mughal Kot and Daraban, conglomerate slopes, 700–900 m. *Kazmi 1970* (PES); *Lamond 1505* (E); *Rechinger 29977* (G, W). HYDERABAD DIST.: Tandojam, Bholari Camp, *M. Ahmad 49* (MICH). JHELUM DIST.: Balkasar oil fields on Chakwal-Balkasar Road, *Arif J. Ahmad s.n.* (PES); Rawalpindi to Jhelum, east of Sohawa, rocky hillsides, *Burttt 1149* (E); Salt Range above Mandiala, *Fleming 73* (E). KOHAT DIST.: Between Gumbat and Khushalgarh, near junction of roads from Attock bridge, *Burttt 1090* (E). MAKHRAN DIST.: Bela, Hab to Diwana, ca. 10 km. from Hab, weed of *Ricinus* fields, *Lamond 772* (E); Bela, 14 km. west of Bela, road to Turbat, sandy plains near foothills, 80 km. *Lamond 291* (E). QUETTA DIST.: Mach, 1000 m. *Jafri 2803* (E); Chuper Rift, 1600 m. *Lace s.n.* (E). RAWALPINDI DIST.: Rawalpindi, Sau (?) hills, *Aitchison 471* (K); Rawalpindi, 570 m. *Kazmi s.n.* (PES), *R. R. Stewart 949* (GH).

2b. Subsp. *brevifolium* (Wall.) Kazmi, comb. nov.

H. brevifolium Wall. in Roxb. Fl. Indica ed. Carey & Wall. 2: 2. 1824; DC. Prodr. 9: 546. 1845; Riedl in Rechinger, Fl. Iranica 48: 16. 1967.

H. strigosum Willd. var. *brevifolium* (Wall.) C. B. Clarke in Hook. f. Fl. Brit. India 4: 151. 1883.

TYPE: India, *Wallich 914* (K).

Decumbent, prostrate or erect, intricately branched; stem, branches, and leaves covered with loosely set trichomes giving the whole plant a greenish-white appearance. Leaves up to 15 mm. long. Fruits not or slightly lobed, not depressed at the top, plane or slightly produced towards the style.

DISTRIBUTION OF SUBSP.: Afghanistan, Pakistan, Kashmir, India, Nepal, Burma, Siam, Hongkong, Hainan, Fukian, and Macao.

West Pakistan: DERA ISMAIL KHAN DIST.: Dera Ismail Khan Proper, banks of Indus, 240 m. *Deane 23* (K). HAZARA DIST.: Balakot, *Jafri & Ali 3262* (E); Mansehra, *Kazmi s.n.* (PES). KARACHI DIST.: Karachi to Mugar Peer, *Perry s.n.* (K); near Behar Colony, along Lyari river, *Jafri 860* (E); in agris incultis, 10–20 km. n. Hab Chauki, *Rechinger 28618* (G, W); Dabbiji, *Koelz 7604* (MICH). LAHORE DIST.: Lahore Proper, *N. (Nath ?) s.n.* (E). LYALLPUR DIST.: Lyallpur proper, *R. R. Stewart s.n.* (18. 3. 1917) (K). PESHAWAR DIST.: Peshawar to

Jhelum, *J. L. Stewart 271/P* (GH). RAWALPINDI DIST.: Rawalpindi Proper, 570 m. *R. R. Stewart 9494A* (GH); Topi Park, *R. R. Stewart 7521* (K); Sangla Hill desert, *R. R. Stewart 1376* (K); between Rawalpindi and Jhelum, stony hillside, *Burtt 620* (E); Panjar, *R. R. Stewart 2853* (E); *Kazmi 2485* (PES); Dharmyal, 560 m. *Nath* in *R. R. Stewart 17259a* (GH).

Kashmir: MUZZAFFARABAD DIST.: Lower Kishanganga Valley, near Muzaffarabad, *R. R. Stewart 17317* (GH). JAMMU DIST.: 10 miles from Jammu, 470 m. *R. R. Stewart 12595* (GH).

The subspecies *strigosum* and *brevifolium* are similar in details of the form of leaves and structure of flowers. Subspecies *brevifolium* differs in habit from the former in usually being decumbent, sometimes prostrate, or at times even erect. The whole plant is less hairy in comparison to subsp. *strigosum*, the trichomes are loosely set and the leaves are shorter. The fruits are plane at the top or more or less produced towards the style. Subspecies *strigosum* has a westerly distribution, while subsp. *brevifolium* represents the eastern range of distribution of the species. West Pakistan and some Western and Central parts of India are actually the areas where these two subspecies overlap and, therefore, in these areas many intermediate forms are found.

3. *H. marifolium* Retz. Obs. Bot. 2: 8. 1781; DC. Prodr. 9: 547. 1845; C. B. Clarke in Hook. f. Fl. Brit. India 4: 152. 1883; Cooke, Fl. Bombay Presidency 2: 213. 1908, excluding syn. *H. rottleri* Lehm.

TYPE: Not indicated. (Described from Koenig's collection from South India.)

Perennial, decumbent or prostrate herb; stems up to 15 cm. long; branches usually spreading near the root, clothed densely or loosely with stiff appressed hairs; hairs 0.5–1 mm. long. Leaves lanceolate to elliptic, 8–20 mm. long, 2–5 mm. broad, earliest ones alternate, fascicled or subopposite, the later ones all alternate, midrib impressed above and prominent beneath, margins usually slightly revolute, apices acute or subacute, bases obtuse or acute, sessile or petiolate; petioles up to 2 mm. long; leaves covered on both surfaces with stiff, straight trichomes, sometimes arising from minute tubercles, trichomes usually more dense below. Inflorescence at first glomerate, in fruit a crowded or loose biserial scorpioid cyme, 1–3(–4) cm. long; bracts spreading, foliaceous, lanceolate, 1–4 mm. broad. Calyx 2–4 mm. long, divided to the base, lobes appressed hispid, lanceolate, becoming enlarged ovate-lanceolate in fruit, calyx sessile or very short pedicellate in fruit. Corolla white, 2.5–3.5 mm. long, not much surpassing the calyx, hairy externally, lobes short, broad, erect, or infolding in bud, throat at summit slightly or densely minutely villose. Anthers 0.7 mm. long, lanceolate; filaments 0.2 mm. long, inserted 0.5–0.7 mm. above the corolla base. Ovary glabrous; stigma 0.5 mm. long, stigmatic disk 0.3 mm. in diameter; style 0.2–0.3 mm. long. Fruits depressed, rounded or lobed, covered partly or fully with short thick hairs, sometimes glabrous.

DISTRIBUTION OF SPECIES: Pakistan, India, and Ceylon.

3a. Subsp. *marifolium*.

Decumbent or prostrate, much branched; branches up to 15 cm. long. Leaves broad lanceolate, acute, 18–20 mm. long, 2–5 mm. broad, short petiolate, covered thinly with sharp trichomes usually arising from tubercles; petioles up to 2 mm. long. Bracts 3–4 mm. long, broadly lanceolate, leaf-like. Corolla throat densely hairy. Fruits bearing trichomes on the top, or glabrous.

DISTRIBUTION OF SUBSP.: South India and Ceylon.

3b. Subsp. *wallichii* (C. B. Clarke) Kazmi, comb. nov.

H. marifolium var. *wallichii* C. B. Clarke in Hook. f. Fl. Brit. India 4: 152. 1883.

TYPE: India, *Wallich 2092* (K).

Usually prostrate rarely decumbent, much branched; branches up to 10 cm. long. Leaves lanceolate, subacute, usually sessile or sometimes the middle leaves very shortly petiolate, 4–10 mm. long, 1.5–2.5 mm. broad, densely covered on both surfaces with stout, white trichomes not usually arising from tubercles, 0.5–1 mm. long; petioles 0.5 mm. long. Bracts lanceolate, 1–2 mm. long, to 1 mm. broad. Corolla throat less hairy. Fruits densely and totally covered with short stout trichomes. Spikes longer than those of subsp. *marifolium*, up to 4 cm. long.

DISTRIBUTION OF SUBSP.: Central and southern parts of West Pakistan, and Rajputana in India.

West Pakistan: BANNU DIST.: Tutaki, 50 km. north of Bannu, 700 m. *Rechinger 30093* (G, W). DADU DIST.: Amri near Sehwan, near Railway Station, *Jafri 2756* (E). KARACHI DIST.: Drigh Road near Dalmia Cement Factory, *Baquar* in *Kazmi 2460* (PES); 12 km. west of Bela, *Rechinger 27583* (G, W); Inter Damloti et Khadiji, *Rechinger 28502* (G, W).

I did not see the type of C. B. Clarke's variety *wallichii* but the other collections in Herb. Ind. Or. Hook. f. & Thoms., determined by Clarke, agree with the specimens cited above from West Pakistan. Subspecies *wallichii* is evidently distinguishable from subsp. *marifolium* by having much shorter and narrower leaves and bracts and longer spikes. The leaves are thickly covered with stouter and longer hairs, usually not arising from tubercles. The plants are mostly prostrate. Subspecies *wallichii* represents the northern area of distribution of *H. marifolium*.

4. *H. zeylanicum* (Burm. f.) Lam. Encycl. Méth. Bot. 3: 94. 1791.

H. curassavicum L. var. *zeylanicum* Burm. f. Fl. Indica 41. t. 16, fig. 2. 1768.
H. linifolium Lehm. Asperif. 35. 1818; DC. Prodr. 9: 547. 1845.

TYPE: South India: Tuticorin, *Garcin* (G).

Usually annual or sometimes perennial, erect, up to 40(–55) cm. tall,

usually branched near the base, branches long and straight; stem and branches pale green to pale brown, or brown at maturity, loosely covered with short appressed trichomes, up to 0.6 mm. long, arising from tuberculate bases, sometimes the lower stem quite glabrous. Leaves subsessile or the lower ones short petiolate, linear, acute, entire, usually revolute at margins, up to 7 cm. long and 3 cm. broad, upper surface slightly hairy or rarely glabrous, lower surface loosely hairy with appressed trichomes, sometimes minutely tuberculate at the base and up to 5 mm. long. Inflorescence terminal or axillary, simple or forked, 3–5 cm. long, in fruit becoming elongated to 10 cm., bearing uniseriate, bracteate flowers or fruits; bracts 2(–3) mm. long, linear, hairy. Calyx sessile or subsessile, or with pedicels hardly up to 0.5 mm. long, divided to the base, lobes lanceolate, more or less acute, hairy outside, usually more on the lower half and at margins, glabrous inside, sometimes subequal, 1.5–2.5 mm. long, 0.5–1 mm. broad. Corolla white with a tiny yellow eye, sparsely hairy externally and slightly so at the throat within, 3.5–4 mm. long, tube 1.5–1.7 mm. long, slightly swollen in the middle, narrowed at mouth, lobes plicate, patent or fully expanded, ovate, rounded or slightly obtuse at the tips, with prominent veins, 1.4–1.6 mm. long, 1–1.2 mm. broad. Anthers ovate, acutish, 0.8 mm. long; filaments about 0.2 mm. long, inserted 0.7 mm. above the corolla base. Ovary glabrous, style very short, 0.1 mm. long, stigma conical, 0.5 mm. long, stigmatic ring conspicuous. Fruits compressed, lobed, covered with loose short trichomes; 2.5 mm. diameter, 1.5 mm. high.

DISTRIBUTION OF SPECIES: Pakistan, India, Ceylon, Siam, Australia, and East Africa.

4a. Subsp. *zeylanicum*.

Calyx up to 1.5 mm. long; corolla 3.5 mm. long, corolla tube much exceeding the calyx; leaves comparatively narrower than those of subsp. *paniculatum*.

DISTRIBUTION OF SUBSP.: South India and Ceylon.

4b. Subsp. *paniculatum* (R. Br.) Kazmi, comb. nov.

H. paniculatum R. Br. Prodr. 494. 1810; DC. Prodr. 9: 547. 1845; C. B. Clarke in Hook. f. Fl. Brit. India 4: 151. 1883; Cooke, Fl. Bombay Presidency 2: 212. 1908.

TYPE: "Habitat in Novae Hollandiae littore intra tropicum" without citation of collector's name (BM, G-DC).

Calyx 2.5 mm. long; corolla 3.5–4 mm. long, corolla tube more or less equalling the calyx, more hairy outside; leaves comparatively broader than those of subsp. *zeylanicum*.

DISTRIBUTION: East Africa, Pakistan, India, Siam, and Australia.

West Pakistan: HAZARA DIST.: Khanpur, R. R. Stewart 28893 (E). JHELMUM

DIST.: Rawalpindi to Jhelum, East of Sohawa, rocky hillsides, fl. white with yellow eye, *Burt 1150* (E). MARDAN DIST.: 15 miles northeast of Mardan, just south of Machai, on open places and rocky hillsides dominated by *Acacia modesta*, fl. white with yellow eye, *Burt 1518* (E). RAWALPINDI DIST.: Rawalpindi, Topi Park, *R. R. Stewart 7520* (K). SHAHPUR DIST.: Sakesar, *Drummond 14560* (E). Miscellaneous: Sind ?, *Stocks s.n.* (K).

Heliotropium zeylanicum (Burm. f.) Lam. is based on *H. curassavicum* var. *zeylanicum* Burm. f., which was collected in Tuticorin, South India, by Garcin. It was the figure by Burmann (l. c. t. 16, fig. 2) from which Lamarck took his description. Wight (Illustr. Indian Bot. 2: t. 170b. 1841) referred it to his *Tournefortia zeylanica*, and later treated it as *Heliotropium zeylanicum* (Icones Pl. Indiae Orient. 3: t. 892. 1849). C. B. Clarke (in Hook. f. Fl. Brit. India 4: 148. 1883) adopted the name *H. zeylanicum* (Burm. f.) Lam. for the plant figured by Wight and this was carried on later by many authors.

As pointed out by Trimen (Fl. Ceylon 3: 199. 1895), proposed by Cooke (Fl. Bombay Presidency 2: 208. 1908), and concurred in by Duthie (Fl. Gangetic Plain 2: 92. 1911), the plant figured by Burmann is different from the plant drawn by Wight. Actually Wight's figure represents *Heliotropium subulatum* (DC.) Vatke, described from the type collected by Schimper in Abyssinia, and has the characteristic caudate-acuminate corolla lobes.

Burmann's figure, in all its details, strictly represents the plant which was later described by Lehmann as *Heliotropium linifolium* from South India or Ceylon.

Subspecies *zeylanicum* agrees in all its characters with subsp. *paniculatum*, except that the calyx in the former is only up to 1.5 mm. long and the corolla tube much exceeds the calyx in length, while in the latter the calyx is more or less equal to the corolla tube. The typical subspecies is confined to South India and Ceylon, while subspecies *paniculatum* is widely distributed.

5. *H. subulatum* (DC.) Vatke, Oesterr. Bot. Zeitschr. 25: 166. 1875.

Tournefortia subulata Hochst. ex DC. Prodr. 9: 528. 1845.

T. edgeworthii DC. Prodr. 9: 527. 1845.

T. royleana DC. Prodr. 9: 527. 1845.

Messerschmidia hispida Benth. in Royle Illustr. Bot. Himal. Mount. 1: 306. 1839.

TYPE: Abyssinia, *Schimper 1285* (B).

ICON.: Wight, Icones Pl. Indiae Orient. 3: t. 892. 1849, under *H. zeylanicum*.

A perennial, but flowering in the first year, erect, to 60 cm. tall. Stem and branches covered with spreading trichomes arising from tuberculate bases. Leaves lanceolate, usually narrowed at both ends, lower short petiolate, upper sessile, acute, margins entirely or slightly undulate, covered on both surfaces with short subappressed trichomes mixed with

long spreading ones arising from minute tuberculate bases, nerves sunken on the upper surface, raised and prominent below, (8-)10-50(-60) mm. long, (2-)4-8(-15) mm. broad. Inflorescence 5-15 cm. long, terminal or axillary, slender, simple or forked, bearing closely set uniseriate flowers or distant fruits, ebracteate. Calyx sessile, deeply 5-lobed, lobes lanceolate, with few short appressed hairs externally, and more densely hairy on the margins, marginal hairs 1.5 mm. long. Corolla white to dirty yellow, 3.5-5 mm. long, with minute appressed trichomes, sometimes arranged in rows outside, glabrous within, corolla tube cylindrical, swollen in the upper part, contracted at throat, lobes incurved in young flowers later patent, caudate acuminate, 1-1.5 mm. long. Anthers oblong, slightly exserted, 1 mm. long, filaments very short, inserted about 2 mm. above the corolla base. Stigma conical, hispid, shorter than the glabrous style. Fruits 2 mm. diameter; nutlets 4, separating first in pairs, later free, brown, rugose or pitted.

DISTRIBUTION: Northeast and central Africa, West Pakistan, and India.

West Pakistan: JHELUM DIST.: Salt Range, sandstone hills above Mandiala, *Fleming 68* (E). KARACHI DIST.: Karachi near Nazimabad, along dry border of Lyari river, fl. dirty yellowish, *Jafri 817* (E); Karachi University Campus, *Rechinger 27533* (G, W), *27534* (W), *Abid 37*, *Kazmi s.n.* (PES); Drigh Road, *Jafri s.n.* (E).

Tournefortia zeylanica Wight (Illustr. Indian Bot. 2: t. 170b. 1841) is a misidentification.

6. *H. crispum* Desf. Fl. Atlant. 1: 151. t. 41. 1798.

Lithospermum hispidum Forssk. Fl. Aegypt.-Arab. 39. 1775.

H. undulatum Vahl var. *ramosissimum* Lehm. Asperif. 24. t. 40. 1831.

H. ramosissimum (Lehm.) DC. Prodr. 9: 536. 1845; Riedl in Rechinger, Fl. Iranica 48: 18. 1967.

H. nubicum Bunge, Bull. Soc. Nat. Moscou 42(2): 330. 1869.

H. persicum Boiss. Fl. Orient. 4: 147. 1875, non Lehm.

H. afghanum Boiss. *Ibid.* 143. 1875.

H. turcomanicum M. Pop. & Korov. Acta Horti Petrop. 42: 246. 1931.

H. sarothroclados Bornm. Beih. Bot. Centralbl. 61(B): 89. 1941.

TYPE: "Habitat in arenis prope Tozzer et Elhammah" without citation of collector's name (P).

ICON.: Desf. Fl. Atlant. t. 41. 1798.

Perennial, usually erect (sometimes suberect or rarely prostrate herb), sometimes shrubby with woody base to 1 cm. thick, up to 60 cm. tall, branched; stem and branches grayish-green, covered with short stiff trichomes mixed with scattered stouter ones arising from tuberculate bases. Leaves lanceolate to linear-lanceolate, lower cauline leaves subsessile or short petiolate, upper cauline leaves usually sessile, sometimes subsessile, margins crenulate, undulate or subentire, nerves and veins sunken on the upper surface, prominent below, covered on both surfaces

with stiff white hairs, intermixed with thicker hairs arising from tuberculate bases, 30–40 mm. long, 5–7.5 mm. broad. Inflorescence terminal, sometimes axillary, usually bifurcate or sometimes solitary, short when young, later much elongated, 2–7 cm. long, bearing single-ranked, ebracteate, usually distant flowers. Calyx sessile, persistent, divided to the base, thickly hairy outside, inside almost glabrous, 1.75–2.5 mm. long, lobes lanceolate, acute. Corolla white, 3–3.5 mm. long, exceeding the calyx, tubular, hairy outside, glabrous within; lobes imbricate, oblongovate or roundish with crenulate margins, 0.7–0.9 mm. long. Anthers sessile, 0.8–1 mm. long, inserted 1 mm. above the corolla base. Stigma conic-elongate, slightly furrowed, minutely bifid at the apex, 0.8 mm. long; style inconspicuous. Fruits lobed, covered with long or short hairs, surface slightly rugulose, 2.5 mm. high, 2.25 mm. in diameter; nutlets 4, not margined, when young in pairs, later free.

DISTRIBUTION: Senegal, Tunis, Egypt, Sinai, Transjordan, Iraq, Aden, South Arabia, Iran, Afghanistan, West Pakistan, and India.

West Pakistan: ATTOCK DIST.: Campbellpur, *R. R. Stewart* 7756 (KAU, MICH), 15308 (GH), 448 (KAU), *Vergury s.n.* (BM). CHAGAI DIST.: E. of Nokundi, sandy roadside, *Lamond* 136 (E); 100–150 km. E. Nokundi, in deserto, *Rechinger* 27271 (G, W). DADU DIST.: Karachi to Dadu, ca. 10–15 km. S. of Sehwan, outermost limestone outcrop, *Kazmi* 1366b (PES); *Lamond* 870 (E, G); *Rechinger* 28719 (G, W). DERA ISMAIL KHAN DIST.: Tank, *Duthie* 7173 (E, K). JHELM DIST.: Salt Range, *Fleming* 69 (E); Langerpur, *R. R. Stewart* 524 (MICH), 526 (K), 445 (KAU); Bhaun, *Bhal* 447 (KAU); Khewra, *Iftakhar* Herb. No. 7302 (LAH). KALAT DIST.: ca. 20 km. W. of Bela, W. of Jan Pass, rocky plateau, 300 m., *Lamond* 310 (E); 30 km. W. of Bela, *Lamond* 316 (E, G); Khuzdar to Wad, ca. 30 km. from Khuzdar, 1150 m. *Lamond* 205 (E); 10 km. S. Khuzdar, *Rechinger* 27392 (G, W). KARACHI DIST.: Karachi Proper, Housing Society, *Ruqayya Islam s.n.* (KAU); *Kazmi s.n.* (PES); Off Malir Cantt., Momen Gate, *Jafri* 1276 (E); Bela, between Hab River and Uthal, *Lamond* 266 (E, G), 270 (E); Malir riverside, *Tasnif in Kazmi* 2461 (PES); Hawkes Bay, *Ali s.n.* (KAU); Dabbiji, *Koelz* 7600 (GH, MICH). KHYBER AGENCY: Torkham, *Anwar* 78 (PEU); near Jamrud, *Kazmi s.n.* (PES); Landi Kotal, *Kazmi s.n.* (PES). LAHORE DIST.: Lahore, *Williams s.n.* (E); *J. L. Stewart* 2582 (K); Mugla near Lahore, *Herb. Ind. Or. Hook. f. & Thoms. s.n.* (K). MAKRAN DIST.: Between Hoshab and Punjgur, ca. 20–30 km. from Punjgur, sandy plains, *Kazmi* 1158 (PES); *Lamond* 578 (E); near Punjgur, 900 m., *Popov* 164, 188 (BM). MIANWALI DIST.: Mianwali, *Kazmi* 1148 (PES); Kalabagh, *Kazmi s.n.* (PES); *Bamber s.n.* (LAH); Mirjal, *A. Ali s.n.* (PFI-M). MUZZAFFARGARH DIST.: Thal, *Sadiq Masih s.n.* (KAU). PESHAWAR DIST.: near Akora, ca. 4 miles W. of Attock Bridge, fl. white, *Burt* 557 (E); Peshawar, *Deane s.n.* (K); *Nath in R. R. Stewart* 15465 (GH); *J. L. Stewart* 115/P (GH); Tehkal, *Hashim* 11 (PEU); Amangarh, *S. R. Khan s.n.* (PEU); Peshawar Cantt., *Kazmi s.n.* (PES). QUETTA DIST.: Quetta, *Lace* 3420 (E); in Valle 12 km. N. Murgha Kibzai, Substr. Tonscheifer, 1600 m. *Rechinger* 29806 (G, W). RAWALPINDI DIST.: Rawalpindi, *Aitchison* 472 (K); *R. R. Stewart* 13792 (GH); *Kazmi* 2462 (PES); Margalla near Rawalpindi, 650 m. *R. R. Stewart* 14664a (MICH); 14664 (GH); Margalla towards Taxila, *Nath in R. R. Stewart* 1166 (KAU); Taxila, *Nasreen Zahida* 31 (PEU); *K. L. Basin s.n.* (ICP). WAZIRISTAN AGENCY: Dattkhel, *Qizilbash* 102 (ICP). ZHOB DIST.:

Fort Sandeman, *Dick-Peddie 304* (KAU). Miscellaneous: Punjab, *Herb. Ind. Or. Hook. f. & Thoms. s.n.* (BM, GH, MICH).

Heliotropium crispum is very variable in the size and pubescence of its leaves. The four nutlets in the unripe fruits remain coherent in pairs and are separated later at ripening of the fruits. The important characters which distinguish this species from its allies are its usually longer inflorescence bearing lax flowers with corollas quite exceeding the calyx; its fruits not at all depressed at the top, but produced towards very short or inconspicuous styles; and its nutlets unwinged at the margins.

7. *H. ophioglossum* Boiss. Fl. Orient. 4: 145. 1875.

H. ophioglossum Stocks ex Aitch. Cat. Pl. Punjab & Sind 94. 1869, *nomen nudum*; C. B. Clarke in Hook. f. Fl. Brit. Ind. 4: 149. 1883; Cooke, Fl. Bombay Presidency 2: 208. 1908; Riedl in Rechinger, Fl. Iranica 48: 17. 1967.

H. ditrichum Stocks in *exsicc.*

TYPE: "Sind: Jemidar ka Landa near Kurrachi" *Stocks 466* (as *H. Ditricho*) (K).

Perennial shrub, erect, 15–50 cm. tall, branched from near the base. Stem and branches clothed with soft trichomes intermixed with stiff long ones (up to 2.5 mm. long) arising from white tuberculate bases. Leaves lanceolate, elliptic or rarely oblanceolate, margins subentire or slightly undulate, apices acute, 1–4(–5) cm. long, 6–12 mm. broad, lower subsessile to very short petiolate, upper usually sessile or subsessile, covered on both surfaces with soft short trichomes intermixed more or less uniformly on the upper surface and mostly on the raised midrib and veins of the lower surface, with stout trichomes up to 2.5 mm. long arising from white tuberculate bases. Inflorescences terminal, simple, geminate, or ternate, densely hairy, 5–15 cm. long, bearing 1–2-ranked, sessile (on the lower part distant) flowers. Calyx falling with the fruit, divided almost to the base, lobes linear-lanceolate, acute, covered externally with long stiff trichomes, internally with comparatively thinner ones, 3–4 mm. long, 0.5–1 mm. broad. Corolla white, slightly exceeding the calyx, cylindric, minutely scabrous externally, glabrous inside, lobes broadly oblong-ovate or suborbicular, obtuse to subacute, undulate, veined, usually with small intermediate teeth in the sinuses, 1 mm. long. Anthers linear-oblong, at tips obtuse, sessile, inserted below the middle of the corolla tube, 2 mm. long. Style very short, stigma short conical at base, prolonged above into a long subulate appendage about 4 mm. long, divided from the apex, for about 1/3 its length, into two filiform recurved acute arms, which are exerted beyond the corolla. Fruits 1.5 mm. long, slightly lobed, dark brown to blackish; nutlets 4, rounded on the back, with mealy apex.

DISTRIBUTION: West Pakistan.

West Pakistan: DADU DIST.: Karachi to Dadu, Thano Bula Khan to Kotri,

outermost limestone ranges, *Lamond 820* (E). KARACHI DIST.: Karachi, Jemidar ka Kanda, *Stocks 466* (K); in *Herb. Ind. Or. Hook. f. & Thoms. s.n.* (BM, GH); Karachi University Campus, *Meher Jahan s.n.* (KAU); *Nusrat Farida s.n.* (KAU); *Kazmi s.n.* (PES); Mungo Pir, *Rehman in R. R. Stewart 25722* (KAU); Manora and Mungo Pir, *Salim 25* (BM); Kinghar Lake (Kinghar Dhan), *Koelz 7599* (MICH); Dabbiji, 35 miles E. of Karachi, grayish woody, 1 ft. high with white flowers, bare ground on roadside, *Burt 1567* (E); north Nazamabad, stony hill base, *Jafri 3733* (E); Drigh Road, sandy ground, *Jafri 917* (E); Maripur, *Stearn 12* (K); Malir Cantt., *Abid 35* (PES); Bela to Diwana, ca. 10 km. from Hab, weed of *Ricinus* fields, *Lamond 373* (E); *Kazmi 903b* (PES); 10–20 km. N. Hab Chowki, in cultis, *Rechinger 28617* (G, W). Miscellaneous: Sind, *Dalzell 16* (K); *Bhola s.n.* (E).

8. *H. bacciferum* Forssk. Fl. Aegypt.-Arab. 38. 1775.

TYPE: Arabia Felix: Lohaja *Forsskål* (C).

Perennial, usually erect, sometimes decumbent or procumbent herb or shrub, usually with woody base, sometimes deeply grooved and up to 3 cm. thick; stem much branched, primary branches usually long, the secondary short, more or less divaricate, covered with appressed or erect, thin or thick, short trichomes, usually arising from white tuberculate bases. Leaves very variable, short, terete, sessile to long, broad, flat, subsessile or tapering at both ends, short petiolate, 10–60 mm. long, 1–10 mm. broad, margins crenulate, undulate and usually revolute, nerves sunken or inconspicuous on the upper surface, prominent and raised on the lower surface, acute, covered on both surfaces with variable, short or long, thin or thick trichomes, from white tuberculate bases or not. Inflorescence strongly reduced, hardly up to 2.5 cm. long, usually with short naked peduncles, mostly in pairs, bearing few, closely set, sessile, ebracteate flowers. Calyx persistent, divided nearly to the base, covered densely with trichomes, lobes ovate-lanceolate, acute. Corolla white, 2.5–3 mm. long, cylindrical, densely covered with trichomes on the outside, glabrous within, corolla tube slightly narrowed at the throat, more or less equalling the calyx, lobes imbricate, very short, hardly 0.6–0.7 mm. long, ovate, sometimes truncate, rarely with short-lacerate margins. Anthers subsessile, oblong, inserted at or below the middle of the corolla tube, 1–1.25 mm. long. Style up to 0.75 mm. long; stigma 1 mm. long, conical, short bifid at the apex, slightly hairy with inconspicuous stigmatic ring. Fruits globose, 2 mm. long and broad; nutlets 4, in 2 pairs, ± winged, smooth, rugulose, or warty, glabrous or sometimes ± hairy.

DISTRIBUTION OF SPECIES: Senegal, Morocco, Tunis, Algeria, Libya, Egypt, Arabia, Iran, and West Pakistan.

KEY TO THE SUBSPECIES AND VARIETIES

- a. Marginal wings of nutlets broad; line of separation of the 2 nutlets in a pair not conspicuous. 8a. subsp. *bacciferum*.
 b. Leaves usually flat, 5–7 mm. broad. 8aa. var. *bacciferum*.
 b. Leaves usually terete, 2–3 mm. broad. 8ab. var. *tuberculosum*.

- a. Marginal wings of nutlets narrow; line of separation of the 2 nutlets in a pair conspicuous. 8b. subsp. *lignosum*.
 c. Leaves usually short and terete, sometimes flat; line of separation of the 2 nutlets in a pair deep. 8ba. var. *lignosum*.
 c. Leaves never terete, always flat, lanceolate; line of separation of the 2 nutlets in a pair not as deep as in var. *lignosum*. . . . 8bb. var. *fartakense*.

8a. Subsp. **bacciferum**.

Nutlets always joined in pairs, pairs winged at the separating margins; wings conspicuous and broad; in every pair of nutlets the line of separation of two nutlets is not conspicuous.

DISTRIBUTION OF SUBSP.: As for the species.

8aa. Var. **bacciferum**.

Leaves usually flat, up to 35 mm. long, 5–7 mm. broad, covered on both surfaces with trichomes not arising from tuberculate bases, or sometimes intermixed with the trichomes arising from tuberculate bases, but only in older leaves.

West Pakistan: DADU DIST.: In collibus calc., 10–15 km. S. Sehwan, *Rechinger* 28739 (g, w); *Bhola Puran* 6 (K). DERA ISMAIL KHAN DIST.: In arenosis montibus, 50 km. N. Dera Ismail Khan, 250 m. *Rechinger* 30025 (g, w). HYDERABAD DIST.: Hyderabad, *Cook s.n.* (K). KALAT DIST.: 30–35 km. W. Bela, *Rechinger* 27670 (g, w). KARACHI DIST.: Bela inter Somniani et Bela, *Rechinger* 27553 (g, w); Inter Damloti et Khadiji, *Rechinger* 28511 (g, w).

8ab. Var. **tuberculosum** (Boiss.) Kazmi, comb. nov.

Heliotropium undulatum Vahl var. *tuberculosum* Boiss. *Diagn. Pl. Orient.* 1(2): 89. 1849.

H. tuberculosum (Boiss.) Boiss. *Fl. Orient.* 4: 147. 1875.

H. kotschyi Bunge, *Reliq. Lehmann* 404. 1851.

H. bacciferum Forssk. subsp. *tuberculosum* (Boiss.) H. Riedl, *Oesterr. Bot. Zeitschr.* 113: 165. 1966; in *Rechinger, Fl. Iranica* 48: 20. 1967.

TYPE: Insula Khark in sinu Persico, *Kotschy* 22 (w).

Leaves usually terete or subterete, up to 10(–20) mm. long, 2–3 mm. broad, covered on both surfaces mostly with stout hairs arising from large white tuberculate bases.

West Pakistan: KARACHI DIST.: Clifton, shrub, 1/2 ft. tall, leaves falling towards the base, *Jafri* 1401 (E); Bela, Uthal to Naka Kharai, *Lamond* 229 (E); *Rechinger* 27474 (g, w); Karachi, *Rehman* in *R. R. Stewart* 25721 (BM); *Nath & Samson* 15320 (GH); *Nath* 15277 (GH). MAKRAN DIST.: Inter Kappar et Gwader, *Rechinger* 27898 (g, w); *Kazmi* 2495 (PES). Miscellaneous: Sind, *Herb. Ind. Or. Hook. f. & Thoms., Stocks* 9 (K); *Cooke s.n.* (K).

Both varieties of subspecies *bacciferum* are distributed from Morocco to West Pakistan on the southern side of the Mediterranean. Variety *tuberculosum* is more common near the sea coasts, while var. *bacciferum*

is usually found in the inland areas. A number of intermediate forms are common all over the area of distribution of the subspecies. Both varieties bear trichomes which arise from tuberculate bases, but such trichomes are less common in var. *bacciferum* than in var. *tuberculosum*. The type of trichome has no relation to the form of the leaves, which is the major distinguishing character of the two varieties.

8b. Subsp. *lignosum* (Vatke) Kazmi, comb. nov.

Lithospermum lignosum Schweinf. ex Vatke, Oesterr. Bot. Zeitschr. 25: 167. 1875.

H. lignosum Schweinf. ex Vatke, loc. cit. 1875.

TYPE: Arabia: Ras Ranar, *Schweinfurth 2111* (B).

Nutlets usually joined in pairs, pairs winged at the separating margins, wings narrow; the line of separation of the two nutlets is conspicuous.

DISTRIBUTION OF SUBSP.: Arabia, West Pakistan, and Egypt(?).

8ba. Var. *lignosum*.

Leaves usually short and terete, sometimes flat and lanceolate, 6–20 mm. long, 3–4 mm. broad, at times lower cauline leaves are broad and the upper short and narrow, covered on both surfaces with hairs arising from white tubercles. The line of separation of the two nutlets in a pair is more conspicuous than in var. *fartakense*, sometimes deeply grooved.

West Pakistan: KARACHI DIST.: Karachi, between Mango Pir and Band Murad, *Jafri 1353* (E); Hawkes Bay, flower white with yellow eye, *Burt 1561* (E). MAKRAN DIST.: between Pasni and Kappar, on Pasni-Gwader Road, *Kazmi 1031* (PES); *Lamond 456* (E); Ras Nuh, south of Gwader, rocky top of cliff promontory, flower white, 100–150 m., *Lamond 483* (E).

8bb. Var. *fartakense* (O. Schwartz) Kazmi, comb. nov.

H. fartakense O. Schwartz, Mitt. Inst. Allg. Bot. Hamburg 10: 207. 1939; Riedl in Rechinger, Fl. Iranica 48: 20. 1967.

TYPE: Arabia: Kustengebiet von Hadramaut auf Dünensand bei Ras Fartak, *Poulay s.n.* (HBG).

Lower cauline leaves lanceolate, tapering at both ends, up to 6 cm. long and 1 cm. broad, upper cauline leaves shorter and narrower; both surfaces uniformly covered with short white trichomes, arising from white tuberculate bases, nerves sunken and glabrous on the upper surface, prominent and densely covered with long trichomes on the lower surface. The line of separation of the two nutlets in a pair is less conspicuous than in variety *lignosum*.

West Pakistan: KARACHI DIST.: Karachi, *Rich 437* (K); *Cooke* (Dec. 1892) s.n. (K). MAKRAN DIST.: Inter Pasni et Kappar, *Kazmi 1026* (PES); *Rechinger 27867* (G, W).

Subspecies *lignosum* is distributed at the eastern end of the range of *Heliotropium bacciferum*. It is differentiated from the typical subspecies by the narrower wings of its seeds and by the very slightly to deeply grooved line of separation between the nutlets in a pair. On ripening of the fruits the nutlets are always separated in variety *lignosum* and usually are in variety *fartakense*. Rarely in variety *fartakense* (*Rich 437*) do the nutlets remain united even on the complete ripening of the fruit, as they do in subspecies *bacciferum*. In the form of leaves the varieties of subspecies *lignosum* differ as do those of subspecies *bacciferum*, and here also many intermediate forms are found. All the four varieties are related in the coherence of the nutlets, from being united to being free in the following sequence: *tuberculosum*, *bacciferum*, *fartakense*, and *lignosum*. In the form of leaves and in habit, variety *lignosum* is closely related to variety *tuberculosum*, and variety *bacciferum* to variety *fartakense*.

9. *H. dasycarpum* Ledeb. in Eichw. Pl. Nov. Iter Casp.-Cauc. 11. 1831–33; DC. Prodr. 9: 535. 1845; Boiss. Fl. Orient. 4: 140. 1875; C. B. Clarke in Hook. f. Fl. Brit. India 4: 148. 1883; Burkill, Fl. Pl. Baluchistan 50. 1909; Riedl in Rechinger, Fl. Iranica 48: 23. 1967.

TYPE: Prope Krasnovodsk, *Eichwald s.n.* (LE).

Perennial herb or undershrub, erect, up to 45 cm. tall, profusely and usually divaricately branched, stem and branches densely covered, with adpressed, or sometimes with spreading, white trichomes not arising from white tuberculate bases, or sometimes intermixed with scattered short trichomes arising from minute tuberculate bases. Leaves lanceolate to ovate, including petioles up to 40 mm. long, to 15 mm. broad, lower and middle cauline leaves with longer petioles, petioles up to 15 mm. long, upper cauline leaves usually with shorter petioles or sometimes sessile or rarely sessile; nerves on the upper surface sunken and not prominent, on the lower surface raised and prominent; upper surface covered with short simple trichomes mixed with a few arising from minute tuberculate bases, lower surface usually more densely covered with a mixture of short and rather longer trichomes arising from tuberculate bases than the upper surface; margins usually revolute; apices round, obtuse or rarely subacute. Inflorescence usually terminal, loose with few distant, sessile, or at fruiting time, sessile to very short pedicellate flowers. Calyx divided nearly to the base, lobes lanceolate to ovate-lanceolate, 1.8–2.8 mm. long, 0.7–1 mm. broad, usually acute, hairy outside, with spreading trichomes. Corolla subtubular, narrowed slightly at the throat, externally silky hairy, glabrous inside, 2–3 mm. long; corolla tube 2.5–3 mm. long, lobes 0.7–1 mm. long, inflexed at 1/2–1/3 of their length, sinuses entire, narrow. Anthers linear-oblong, emarginate at the bases, sessile, inserted 1 mm. above the base of corolla, 1.2–1.5 mm. long. Stigma 1 mm. long, cylindrical with prominent disc, glabrous or slightly puberulous, usually with longer trichomes at the tip; style much shorter than the stigma. Fruits

globose, up to 2.5 mm. in diameter, when young covered with long silky trichomes, becoming glabrous; nutlets 4, free, dark brown to black.

DISTRIBUTION OF SPECIES: Iran and adjoining areas of URSS, Afghanistan, South Siberia, and West Pakistan.

9a. Var. *dasycarpum*.

Stem and branches densely covered with white trichomes, usually not arising from tuberculate bases or sometimes intermixed with a few which do so. Leaves mostly tapering at both ends. Calyx lobes broader and corolla lobes shorter than those of var. *gymnostomum*.

West Pakistan: KALAT DIST.: Mastung, 1840 m., *Jafri & Akbar 1714* (E); *G. Popov 292* (BM); Mastung on the way to Spin Blundi, 1800 m., *Jafri & Akbar s.n.* (E). QUETTA DIST.: Quetta, Sariat road, 5 km. from center, weed of vineyards, 1700 m., *Kazmi 1441B* (PES); *Lamond 927* (E, G); *Rechinger 28831* (G, W); Kach, *R. R. Stewart 549* (MICH).

9b. Var. *gymnostomum* (Hemsl.) Kazmi, comb. nov.

H. gymnostomum Hemsl. in Hook. Icon. 18: t. 1755. 1883.

TYPE: Gilgit Expedition, Roshan at 10,000 ft., *Dr. Giles s.n.* (K).

ICON.: Hemsley, *l.c.* 1883.

Stem and branches usually covered thinly with scattered short, spreading hairs, usually arising from tuberculate bases, older stems sometimes glabrous below. Leaves usually ovate, not much attenuated towards the base, sometimes truncate. Calyx lobes narrower and corolla lobes longer than in var. *dasycarpum*.

West Pakistan: GILGIT AGENCY: Gilgit valley, 1300–1800 m., *Duthie* (30. 7. 1892) *s.n.* (K); Gilgit Expedition, *Giles* (marked = *Griffith* No. 585) *s.n.* (E); Gilgit, river terrace, poor sandy soil, irrigated and cultivated area, flowers cream-yellow, 1580 m. *Polunin 6025* (E); Gilgit in deserts, 1800 m., *R. R. Stewart 16196* (A); Gilgit, watershed Gilgit river, *Giles 239* (K); Astor, *Duthie 12293* (K).

In the original description of Ledebour the nutlets of *Heliotropium dasycarpum* are cited as being glabrous, other authors described the nutlets as glabrous or as hairy. Most of the specimens examined by me from West Pakistan and other areas of the distribution of the variety have long silky trichomes which, in some cases, especially in fully ripe and old nutlets, have fallen off. Hemsley, in his description of *H. gymnostomum*, incorrectly considered the silky trichomes of the nutlets as the part of the corolla tube remaining attached to the fruit. The important distinguishing character of *Heliotropium dasycarpum* is its very short, more or less glabrous style, which is much shorter than, or hardly reaching 1/5–1/3 of the length of the stigma. The specimens cited under variety *gymnostomum*, mostly from northern West Pakistan, are thinly covered with crisped, short trichomes, mostly spreading and almost arising from

minute tuberculate bases. These trichomes sometimes fall along with the calcareous discs (in age), leaving the lower stems quite glabrous, which is not the case in variety *dasycarpum*. Moreover, the leaves of variety *gymnostomum* are ovate and sometimes truncate at the base in comparison with leaves of variety *dasycarpum* which are usually tapering at both ends. Similarly, the Gilgit specimens have longer and narrower corolla lobes in comparison with those of specimens from Baluchistan.

10. *H. brahuicum* Stocks in Hook. Jour. Bot. 4: 173. 1852.

H. rechingeri H. Riedl in Rechinger, Fl. Iranica 48: 25. 1967, *syn. nov.*

TYPE: Upper Beloochistan, about 4,000 ft., *Stocks 865* (K).

ICON.: Rechinger, Fl. Iranica 48: t. 8. 1967, under *H. rechingeri*.

Perennial herb or undershrub up to 30 cm. tall; stems many, branched; stem and branches covered with appressed, antrorse or erect white trichomes, mostly arising from small tuberculate bases. Leaves petiolate, petioles 3–10 mm. long, longer in middle cauline leaves; lamina ovate, acute or obtusish, usually truncate at base, sometimes attenuate, nerves inconspicuous on the upper surface, prominent below, upper surface covered with thin short trichomes, lower surface densely covered with longer ones; margins usually subrevolute, 7–20 mm. long, 6–14 mm. broad. Inflorescence usually terminal, lax, flowers subsessile or sessile, lower old flowers or fruits 5 mm. apart, shortly pedicellate; pedicels up to 1.5 mm. long. Calyx 2.5(–3) mm. long, divided to the base, lobes lanceolate, acute, covered on the upper surface with few hairs, more densely so on the margins, trichomes sometimes hooked at their tips. Corolla ca. 5 mm. long, tubular, pallid, externally covered with thin, short, silky, retrorse trichomes, glabrous within, lobes 0.9–1.2 mm. long, 0.5–0.6 mm. broad at bases, obtusish, incurved at about 2/3 of their length, sinuses between the lobes broad, sometimes lobed or slightly dentate. Anthers oblong to linear-oblong, bases more or less roundish 1.6–2 mm. long; sessile, inserted 1.8–2 mm. above the corolla base. Stigma conical to conical-oblong, 1–1.4 mm. long, stigmatic ring 0.6–0.7 mm. in diameter, slightly puberulous with longer trichomes at the top; style retrorse strigose, 0.8–1 mm. long. Ovary glabrous. Fruits not seen.

DISTRIBUTION: West Pakistan.

West Pakistan: KALAT DIST.: Dasht Baddoo near Kalat, 1900–2000 m., *R. R. Stewart 744* (MICH); Mastung, *M. A. Siddiqui 1948* (K). PISHIN DIST.: Pishin, *Lace s.n.* (E, K). QUETTA DIST.: Ad radices occidentalis montium Chiltan inter Dulai et Kanak, substr. calc., 1600 m. *Rechinger 29115* (G, W); *Kazmi 1550A* (PES); Quetta, Gloucester (Gloucester) Road, *Santapau 6285* (GH). Miscellaneous: Upper Baluchistan, above 1300 m., *Stocks 865* (K).

Heliotropium brahuicum is closely related to *H. dasycarpum* from which it is distinguished by its narrower corolla lobes with broad sinuses. The sinuses are usually 1–3-lobed, sometimes minutely dentate, and rarely

entire. The style of *H. dasycarpum* is glabrous and always shorter than the stigma but the style of *H. brahuicum* equals the stigma in length and has prominent retrorse trichomes.

The specimens cited under *Heliotropium rechingeri* agree in all details with *H. brahuicum* and simply represent the more pubescent form with leaves not or slightly undulate at the margins.

11. *H. gillianum* (H. Riedl) Kazmi, comb. nov.

H. popovii H. Riedl subsp. *gillianum* H. Riedl in Rechinger, Fl. Iranica 48: 27. 1967.

TYPE: Afghanistan: North Herat, 490 m., *Gilli 3106* (w).

Perennial herb, branched from the base, base subligulate; stem 30–40 cm. tall; stem and branches densely covered with thin, appressed, up to 1 mm. long trichomes intermixed with some spreading ones arising from minute tuberculate bases. Leaves petiolate, petioles 2–10 mm. long; lamina broad ovate, obtuse to acutish, bases truncate 6–20 mm. long, 5–15 mm. broad; margins crenulate to somewhat undulate and slightly revolute; upper surface covered with thin, appressed trichomes up to 0.2 mm. long, arising from minute tuberculate bases, these denser along the sunken nerves, mixed with sparsely scattered white trichomes up to 0.5 mm. long, arising from comparatively larger tuberculate bases, lower surface densely covered with trichomes 0.3–0.7 mm. long, becoming longer on the raised nerves. Inflorescence terminal or axillary, simple or geminate, 3–15-flowered, when young contracted, later elongate with lower flowers 3–5 mm. apart. Calyx sessile, ca. 3 mm. long, divided to the base; lobes lanceolate to ovate-lanceolate, acute, spreading, falling with the fruits, externally densely covered with white hairs. Corolla tubular, exceeding the calyx, 4–5(–5.5) mm. long, outside densely covered with retrorse trichomes, inside hairy above the anthers and usually along the nerves which alternate with the stamens; lobes 1–2 mm. long, sublinear with plicate aestivation, acute, inflexed at 1/2–1/3 of their length. Anthers 1.5–2 mm. long, broadly cordate at base, gradually narrowed towards the subacute apices, sessile, inserted 1.5–2 mm. above the corolla base. Stigma conical-elongate, hispid at apex, up to 1.5 mm. long. Style slightly hairy, 0.7 mm. long. Nutlets ovoid, convex dorsally, smooth, glabrous, 2 mm. long.

DISTRIBUTION: Iran, Afghanistan, W. Pakistan.

West Pakistan: CHAGHI DIST.: 20–30 km. E. Mirjaveh, in deserto, *Rechinger 27256* (g, w); 100–150 km. E. Nok Kundi, *Rechinger 27273* (g, w).

Heliotropium gillianum may be easily distinguished from other closely related species with inflexed corolla lobes in West Pakistan where this species is the only one of the group having internally hairy corollas. The two specimens cited above were cited under *H. taftanicum* Rech. f., Aellen & Esfand. by Riedl in Rechinger, Fl. Iranica 48: 25. 1967. On

dissecting the flowers, I found, however, that they represent *H. gillianum*.

Heliotropium gillianum is based on *H. popovii* H. Riedl subsp. *gillianum* H. Riedl and is distinguished from the typical subspecies by having longer corolla lobes inflexed at their apices, and internally hairy corollas. In *H. popovii* the corolla is glabrous within, its lobes do not exceed 0.7 mm. in length, and they are not inflexed at their apices. *Heliotropium popovii*, which is based on *H. gymnostomum* M. Pop. Acta Horti Petrop. 42: 239. 1931, non Hemsl. 1883, and variety *aucheriiforme* M. Pop. also differ from *H. gillianum* in the size of leaves, petioles, and flowers and in the pubescence of stem and leaves. *Heliotropium gillianum* seems, therefore, to merit specific recognition.

12. *H. lamondiae* Kazmi, sp. nov.

TYPE: West Pakistan, Baluchistan, Chagai, 20–30 km. E. Mirjaveh, desert, *Jennifer Lamond 134* (E-holotype).

Herba perennis, basi lignosa, pluricaulis, a basi ramosissima, erecta vel ascendens, 15(–30) cm. alta. Caulis ramique pilis ad summum 1 mm. longis appressiusculis vel \pm patentibus interdum tuberculo minutissimo insidentibus densissime hirsuti. Folia omnia brevi-petiolata, petiolo 1–4 mm. longo, lamina 3–12(–15) mm. longa, 3–12(–14) mm. lata, late ovata, obtusa vel rotundata, basi truncata, margine crenulata revoluta, nervi supra valde impressi subtus prominentes, supra viridia plerumque appressissime pilosa, pilis 0.3–0.4 mm. longis, nonnunquam etiam pilis longioribus, 0.5–0.7 mm. longis intermixtis, subtus densissima albidivulvula vel canescenti-pilosa in sicco coriacea. Inflorescentiae terminales vel axillares, simplices, 3–7-florae, primo valde contractae demum elongatae, usque 3 cm. longae. Calyces sessiles vel subsessiles, \pm 2 mm. longi, laciniis 5, usque ad basin liberis, lanceolatis, \pm acutis, densissime subappressiusculis vel patulae albo-pilosis. Corolla tubulosa, pallida, 3–3.5 mm. longa, extus dense retrorse pilosa intus glabra, lobis triangularibus, subacutis, 0.5 mm. longis, 0.5 mm. ad basin latis, in sinibus inter lobos dentibus acutis, brevissimis 0.1 mm. longis distinctis praedita. Antherae oblongae, 1.6 mm. longae, a basi latissime cordatae, apice versus attenuatae; connectivum parve productum, hamato-incurvatum, 1–1.5 mm. supra basin corollae insertum. Stylus 0.3–0.5 mm. longus, pilosus. Stigma conicum, 0.5–0.7 mm. longum ad apicem pilosum. Nuculae ovoideae 2.5 mm. longae, primo albo-sericeae demum glaberrimae, purpureo-flavescentes.

DISTRIBUTION: West Pakistan.

West Pakistan: CHAGAI DIST.: 20–30 km. E. Mirjaveh, desert, *Lamond 134* (E).

Heliotropium lamondiae is closely related to *H. aucheri* from which it differs in having shorter and broader leaves, shorter calyx and corolla lobes. The corolla lobes of *H. aucheri* are linear with narrow and entire sinuses 0.8–1 mm. long, while those of *H. lamondiae* are triangular and do not exceed 0.5 mm. in length, with sinuses obviously lobed or dentate.

Heliotropium lamondiae has anthers about one and a half times longer than those of *H. aucheri*.

13. *H. aucheri* DC. Prodr. 9: 533. 1845; Boiss. Fl. Orient. 4: 143. 1875; Riedl in Rechinger, Fl. Iranica 48: 26. 1967.

H. sericocarpum Bunge, Bull. Soc. Nat. Moscou, 42(1): 322. 1869.

TYPE: Prope Mosul, *Aucher s.n.* (G).

Perennial, erect or suberect herb with many flexuose stems; stem and branches covered with short, appressed or subappressed, white trichomes intermixed with longer, stiff, spreading ones up to 1.5 mm. long. Leaves petiolate, ovate or orbicular, sometimes subcordate at the base, up to 25 mm. long, 15–20 mm. broad, upper surface covered with \pm adpressed short, white, thin trichomes intermixed with longer and thicker ones arising from tuberculate bases, lower surface densely hairy; margins crenulate, revolute. Inflorescence usually solitary, sometimes geminate, short with few distant flowers. Calyx divided to the base, lobes linear, obtuse, hairy, ca. 2.5 mm. long. Corolla subtubular, covered externally with retrorse silky short trichomes, glabrous inside 3–3.5 mm. long; lobes linear, acute, inflexed when young, later spreading, 0.8–1 mm. long. Anthers 1 mm. long, oblong, sessile, connectives produced at apices and recurved, inserted about 1–1.3 mm. above the corolla base. Style 0.7 mm. long, with retrorse thin trichomes. Stigma more or less equalling the style, conical-elongate, hairy at apex. Fruits covered with white trichomes.

DISTRIBUTION: Iraq, southern and central Iran, and West Pakistan.

West Pakistan: KALAT DIST.: Kalat, 1200 m. *McCann 394, 402* (BM).

14. *H. cabulicum* Bunge, Bull. Soc. Nat. Moscou 42(2): 328. 1869; Boiss. Fl. Orient. 4: 143. 1875; Burkill, Fl. Pl. Baluchistan 50. 1909; Riedl in Rechinger, Fl. Iranica 48: 29. 1967.

TYPE: Afghanistan, *Griffith 5930* (K).

Perennial, usually with many stems arising from a woody base, erect, 30–40(–45) cm. tall; stems green, much branched, branches straight or flexuose, covered thinly with short, usually antrorse, crisped trichomes up to 0.7 mm. long, arising from minute tuberculate bases. Lower cauline leaves very short petiolate, middle and upper ones usually sessile or subsessile, lanceolate to ovate-lanceolate, obtusish to acute, up to 30 mm. long, up to 17 mm. broad, nerves on the upper surface \pm sunken, less conspicuous, those on the lower surface raised; upper surface covered with distant short, \pm erect trichomes usually arising from tuberculate bases, lower surface sometimes \pm glabrous, except on nerves; margins entire, often slightly revolute. Inflorescence usually terminal, solitary or geminate, 3–7-flowered, short when young, later elongated with flowers up to 7 mm. apart. Calyx usually sessile or sometimes pedicellate, pedicels 2–3 mm., rarely up to 10 mm. long, lobes free to the base, ovate-

lanceolate, gradually tapering towards the acute apices, externally thinly covered dorsally and thickly at the margins with short trichomes, up to 0.5 mm. long, usually arising from tuberculate bases, lobes 3–3.5(–4) mm. long, 1.3–1.5 mm. broad. Corolla 6–8 mm. long, infundibular, externally covered with spreading trichomes, denser on veins, comparatively softer and longer trichomes within from the bases of the anthers to the tips of the corolla lobes, dense at throat and veins; corolla tube \pm 6 mm. long, lobes 1.5–2 mm. long and broad, roundish, undulate at margins, spreading. Anthers ovate, sessile, roundish or subcordate at the bases, gradually attenuated towards the apices, 1.5–1.7 mm. long, inserted about 1 mm. above the corolla base. Stigma pyramidal, glabrous, subsessile 0.7–0.8 mm. long, 0.7–0.8 mm. in diameter. Fruits glabrous, dark brown, 2 mm. high, 2–2.5 mm. in diameter.

DISTRIBUTION: Afghanistan and West Pakistan.

West Pakistan: KURRAM AGENCY: Parachinar, 1–10 km. E. of town, roadside, shingle plain, 1500 m., *Lamond 1892* (E); Thal to Parachinar, roadside slope, flowers white, *Lamond 1869a* (E); *Rechinger 30886* (G, W); Inter Amal Kot et Sadda, in glariosis, 1500 m., *Rechinger 30959* (G, W); Kurram valley, *Afandi 313* (PES). WAZIRISTAN AGENCY: Waziristan, Wana, 1580 m., open hillside, *D. Lowndes 1661* (E). Miscellaneous: Kabul to Jamrud, *Aitchison 235* (E).

15. *H. ulophyllum* Rech. f. & H. Riedl in *Rechinger, Fl. Iranica* 48: 31. 1967.

TYPE: West Pakistan: In parte inferiore faucium Torkhan supra Harnai, 900 m. 14. 5. 1965, *Rechinger 29487* (W).

Perennial with woody base, erect, 30–45 cm. tall; stem and branches densely covered with white short (0.2–0.3 mm. long), crisped, rigid, usually spreading or sometimes \pm retrorse trichomes, arising from minute tuberculate bases. Cauline leaves petiolate, petioles 1–6 mm. long; lamina 10–40(–45) mm. long, (4–)6–25 mm. broad, ovate to oblong-ovate or oblong-lanceolate, obtuse to acutish, oblique towards the petiole, rarely subhorizontally truncate; margins undulate to crisped-undulate, slightly revolute, nerves on the upper surface inconspicuous, prominent below, upper surface thinly, lower surface densely clothed with trichomes like those of the stem; upper cauline leaves like the lower but shorter, narrower, and sessile. Inflorescence lax, bearing up to 12 flowers, solitary or geminate. Calyx subsessile or sessile, 3.5–4 mm. long, divided to the base, lobes lanceolate, acute, covered externally with spreading trichomes denser on the margins, and within with longer, thinner, appressed trichomes. Corolla infundibuliform, ca. 5 mm. long, with short, subpatent, \pm retrorse hairs outside, glabrous within, tube 3.5–4 mm. long, lobes 1–1.5 mm. long and broad at bases, rotund, slightly lobed or crisped at margins, patent. Anthers sessile, oblong, slightly cordate at base, gradually attenuated towards the apices, ca. 2 mm. long, inserted 1 mm. above the base of corolla. Style glabrous 0.4–0.5 mm. long; stigma conical 0.8–0.9 mm. long. Immature fruits glabrous, smooth.

DISTRIBUTION: West Pakistan.

West Pakistan: QUETTA DIST.: Loralai to Harnai, below Torkhan Pass, near Harnai, 900–1400 m., *Kazmi 1699A* (PES); *Lamond 1274* (E); *Rechinger 29487* (W).

Heliotropium ulophyllum resembles *H. cabulicum* from which it is distinguished in having the calyx nearly equalling the corolla tube, the shorter corolla glabrous within, and longer anthers.

16. *H. remotiflorum* Rech. f. & H. Riedl in *Rechinger, Fl. Iranica* 48: 35. 1967.

TYPE: West Pakistan: Makran, Sunster versus Kikki, 17. 4. 1965, *Rechinger 27990* (w-holotype, g-isotype).

ICON.: *Rechinger, Fl. Iranica* 48: t. 10. 1967.

Annual (?) or perennial, erect or suberect, much branched, branches long, slender. Stem and branches covered with short, appressed hairs up to 0.3 mm. long, intermixed with scattered thick, spreading straight or slightly curved trichomes arising from large tuberculate bases and up to 0.7 mm. long. Leaves petiolate, petioles up to 7 mm. long, hairy, lamina ovate, up to 13 mm. long, and 7 mm. broad, apices obtuse or roundish, bases round or sometimes truncate, margins entire, sometimes slightly revolute, nerves inconspicuous or sunken on the upper surface, prominent and raised below, upper surface \pm rugose, covered uniformly with very short (to 0.2 mm. long) trichomes, lower surface with longer ones up to 0.5 mm. long, denser on the nerves, arising from conspicuous tuberculate bases. Inflorescence terminal or axillary, usually geminate sometimes solitary, short when young, later elongate, up to 12 mm. long with flowers 1–5 mm. apart. Calyx usually sessile or the lower flowers pedicellate (pedicels up to 1.5 mm. long), divided to the base, lobes ovate to broad-lanceolate, obtusish, in fruit patent, persistent, later deciduous, 2–2.5 mm. long, 0.6–0.8 mm. broad. Corolla externally covered with short, silky, retrorse trichomes, internally papillose at the constricted throat 2.5(–3) mm. long, lobes narrow, obtuse, plicate, inflexed when young, later patent, ca. 1 mm. long, 0.5 mm. broad at base. Anthers ovate, 1 mm. long, slightly bifid at apex, \pm cordate at base; filaments 0.1–0.2 mm. long, inserted 0.6–0.7 mm. above the corolla base. Stigma sessile, glabrous, at apex bifid and hairy, 0.9–1 mm. long, 0.7–0.8 mm. in diameter at the base. Fruits 1.7 mm. high, 1.8–2 mm. in diameter, lobed, nutlets coherent when young becoming free, covered with long silky trichomes, dark brown to blackish.

DISTRIBUTION: West Pakistan.

West Pakistan: MAKRAN DIST.: Sunster versus Kikki, *Rechinger 27790* (G, W); Inter Gwader et Sunster, *Rechinger 27972* (W); inter Pasni et Kappar, *Rechinger 27875, 27884* (G, W); between Kappar and Gwader, *Kazmi 1036* (PES); 90–100 km. S. Turbat versus Pasni, *Rechinger 27847* (W).

17. *H. baluchistanicum* Kazmi, sp. nov.

TYPE: West Pakistan: Baluchistan: Mir Ali Khel, 1200 m., 17. 5. 1896, *Duthie 18922* (K-holotype).

Perennis, basi lignescens, 15–25 cm. alta. Caules ad basim ramosi, ramis elongatis pilis tenuibus, crispis, adpressis vel patulis, brevioribus vel usque ad 1.2 mm. longis, densis obsitus. Folia inferiora longius vel superiora brevius petiolata, petiolis 2–10 mm. longis, lamina 10–25 mm. longa, 10–20 mm. lata, late ovata, basi late cuneata vel truncata, nervis supra impressis, subtus parve prominentibus, apice plerumque rotundata vel interdum parve obtusiuscula, margine integra haud revoluta, coriacea, colore sordide saepe brunnescenti- vel canescenti-viridi, indumento e pilis brevibus usque ad 1 mm. longis, crispis et glandulosis numerosis et pilis eglandulosis in pagina superiore dense, in pagina inferiore longioribus usque ad 1.5 mm. longis, multo dense, patule consistente. Inflorescentiae juveniles contractae demum paulo elongatae usque ad 5(–6) cm. longae, terminales vel axillares; plerumque geminatae vel rarissime solitariae, ebracteatae, floribus haud distantibus. Calyces sessiles vel rarissime inferiores subsessiles, 4–5 mm. longi, indumento ut in caule ad basin in laciniis 5 anguste linearibus, 0.5 mm. vix latis, obtusis divisi, post florendum persistentes. Corolla 6.5–7.2 mm. longa, anguste tubulosa, extra dense, patule tomentella, lobis 5 minutis, aestivatione a latere plicatis, suberectis, triangularibus vel late subrotundatis, usque ad 0.5 mm. longis, a basi 0.6–0.7 mm. latis, intus altero annulo pilorum super antheras, altero in fauce ornata, zona pilosa 1–1.5 mm. lata, pilis ca. 0.5 mm. longis, zona glabra 1–1.5 mm. lata. Antherae 1.5–1.7 mm. supra basin corollae sessiles, 1 mm. longae, oblongae, connectivum parve productum, rectum, acutae, basi rotundatae. Stigma 0.6–0.7 mm. longum, basi discoideum fere diametro appresso-conicum, apice rotundatum, glabrum; stylus 0.5 mm. longus, crassus, glaber. Ovaria glabra. Nuculae 2.2 mm. longae, 1.1 mm. latae, ovoideo-oblongae, dorso valde convexae, apicem productae, glaberrimae, flavae vel fuscae.

DISTRIBUTION: West Pakistan.

West Pakistan: Baluchistan, Mir Ali Khel, 1200 m., *Duthie 18922* (K).

Heliotropium baluchistanicum resembles *H. biannulatum* and also *H. dicriophorum* Rech. f. & H. Riedl (Biol. Skr. 13(4): 186. fig. 142. 1963), a species described from Afghanistan. It is well distinguished from *H. biannulatum* by having two rings of hairs inside the corolla, above the anthers and below the corolla lobes, distinctly separated by a glabrous zone (see observations under *H. biannulatum*) and from *H. dicriophorum* by having very short and broad corolla lobes not exceeding 0.5 mm. in length, and much shorter (only up to 1 mm. long) anthers. It also differs from both these species in the pubescence of stem and leaves. The trichomes in *H. baluchistanicum* are very long and crisped in comparison with the other two species.

18. *H. biannulatum* Bunge, Bull. Soc. Nat. Moscou 42(2): 300. 1869; Boiss. Fl. Orient. 4: 135. 1875; Riedl in Rechinger, Fl. Iranica 48: 36. 1967.

H. khyberianum Rech. f. & H. Riedl in Rechinger, Fl. Iranica 48: 35. 1967, *syn. nov.*

TYPE: In regno Cabulico, *Griffith 5933* (GH, K, P, W).

Perennial, erect, 20–30(–35) cm. tall, usually many stems arising from a woody base, stems branched, stem and branches grayish white, covered densely with thin, short, \pm appressed trichomes, not arising from tuberculate bases, intermixed with (up to 0.5 mm.) long ones. Leaves petiolate, petioles 0.5–20 mm. long, hairy; lamina usually ovate to ovate-oblong, up to 5 cm. long, up to 2.5(–3) cm. broad; nerves deeply sunken on the upper surface, prominent below, margins usually entire, rarely slightly undulate, apices usually obtuse, sometimes roundish, rarely acutish, bases usually attenuated towards the petioles, sometimes truncate or subcordate, upper surface densely and uniformly covered with thin, up to 0.5 mm. long, \pm appressed trichomes, not arising from tuberculate bases, lower surface more densely hairy on nerves and veins, giving a honeycomb appearance. Inflorescence usually terminal, simple or geminate, up to 10 cm. long (remaining scorpioid even at fruiting), with closely set uniseriate flowers. Calyx sessile, persistent or rarely deciduous with the fruit, 3–5.5 mm. long, divided to the base, lobes linear, up to 0.7 mm. broad, obtuse to acutish, externally densely covered with \pm patent trichomes up to 0.5 mm. long, erect, after fruiting wide open or sometimes reflexed. Corolla tubular, 5–7 mm. long, externally covered with short, usually retrorse, sometimes subpatent trichomes, densely hairy above the anthers and below the corolla lobes within, leaving a less or sparsely hairy zone in between, trichomes to 0.7 mm. long; corolla lobes 0.5–1.5 mm. long, 0.5–1.2 mm. broad, ovate or roundish, entire, imbricate, glabrous to puberulous inside, erect or patent. Anthers sessile, ovate-oblong, 1.2–1.3 mm. long, connectives very slightly produced, erect, acute, at bases roundish or slightly dilated, inserted ca. 2 mm. above the corolla base. Stigma 0.6–0.9 mm. long, compressed conical, round at apex, discoid at base, base 0.7 mm. in diameter, sometimes fleshy and slightly undulate, glabrous; style slender, glabrous 0.4–0.6 mm. long. Ovary glabrous, nutlets 4, free, glabrous, smooth or sometimes slightly punctate, acutish at apices, 1.4–1.6 mm. long, 0.8–1 mm. broad.

DISTRIBUTION: West Pakistan and Afghanistan.

West Pakistan: KHYBER AGENCY: Machi Kand, flowers yellow, *Nath* in *R. R. Stewart 15433* (GH); Jamrud, Bara Fort, gravel cliffs of dry nullah, flowers deep yellow, *Burt 702* (E); in jugo Landi Kotal, 700–1000 m., *Rechinger 19368* (G, W); Tor Khama, ad confinis Afghanistaniae, 700 m., *Rechinger 30352* (G, W); Peshawar to Tor Kham, Khyber Pass, steep roadside slopes, shale, flowers golden yellow, 650–900 m., *Lamond 1586* (G, E); Khyber Pass, *Faridi s.n.* (MICH); *Kazmi s.n.* (PES); Tor Kham near Afghan-Pakistan border, *A. J. Ahmad 21* (PES). PESHAWAR DIST.: Peshawar, *J. L. Stewart 178* (GH).

The corolla of *Heliotropium biannulatum* is hairy within from above the anthers to the bases of the corolla lobes, but the length and density of the trichomes are not uniform throughout. The trichomes just above the anthers and just below the bases of the corolla lobes are longer and denser in comparison with those of the intermediate zone which is loosely and sparsely pubescent with usually short trichomes. Sometimes at a glance it appears, as it also does from the name *biannulatum*, that there are two rings of trichomes, but actually the two zones are not separated by a glabrous zone as in *H. baluchistanicum*, but are continuous with shorter and loose trichomes.

Heliotropium khyberianum has been distinguished from *H. biannulatum* by three characters, viz., two zones of trichomes separated by a glabrous zone, undulate margins of the stigmatic rings, and yellow flowers. As mentioned above, the density and length of the trichomes of the intermediate area inside the corolla of *H. biannulatum* are quite variable and *H. khyberianum* represents the plants which have comparatively shorter and less dense trichomes in the intermediate zone. The undulate margin of the stigmatic ring is also variable and is not confined only to the plants of Khyber Pass or *H. khyberianum*, but this variation is also found in the plants belonging to *H. biannulatum* from Afghanistan; moreover, this character can not be correlated with any other distinguishing characteristic. I did not find, in any description, or in a note on any sheet, remarks concerning the color of the flower of *H. biannulatum*, but from the herbarium specimens I examined, they appear to be yellowish and therefore, not different from those of *H. khyberianum*.

19. *H. calcareum* Stocks, Hook. Jour. Bot. 4: 174. 1852; Boiss. Fl. Orient. 4: 128. 1875; C. B. Clarke in Hook. f. Fl. Brit. India 4: 150. 1883; Burkill, Fl. Pl. Baluchistan 50. 1909; Riedl in Rechinger, Fl. Iranica 48: 42. 1967.

H. multiflorum Rech. f., Aell. & Esfand., Ann. Naturh. Mus. Wien 58: 44. 1951; Riedl in Rechinger, Fl. Iranica 48: 33. 1967, *syn. nov.*

TYPE: Hills of Scinde and lower Beluchistan, *Stocks 630* (K).

ICON.: Rechinger, Fl. Iranica 48: t. 5, fig. 1; t. 12, fig. 3. 1967.

Annual, 30–40 cm. tall; stems single or many, arising from the woody base, erect or ascendent, branched, branches usually curved; stem and branches grayish, densely covered with up to 0.3 mm. long subappressed hairs, usually mixed with up to 0.6 mm. long, spreading hairs. Lower, middle, and sometimes even the upper leaves petiolate, petioles 10–20(–30) mm. long; upper and uppermost leaves sometimes sessile; lamina oblong-ovate, ovate or broadly ovate, slightly attenuated, roundish or truncate at base, apices usually obtusish, sometimes roundish or acute; margins entire or subentire, sometimes revolute up to 5 cm. long, up to 3.5 cm. broad; nerves on the upper surface sunken, raised and prominent below; upper surface covered with white or grayish, thin (to 0.5 mm. long) hairs which are denser on the lower surface. Inflorescence short

when young, later elongated to 12 cm., usually geminate, spreading, many flowered. Calyx deciduous, sessile, divided to the base, lobes linear to oblong-lanceolate, acutish, 2–3 mm. long, 0.5–0.7 mm. broad, externally covered with patent \pm antrorse white hairs, up to 0.5 mm. long, inside with longer and thinner trichomes. Corolla 3–4 mm. long, tubular, externally densely covered with retrorse, silky trichomes, glabrous within, corolla tube 2.5–3.5 mm. long, lobes roundish to broad ovate, entire, 0.4–0.5 mm. long, 0.5–0.7 mm. broad, rarely with minute intermediate lobes. Anthers sessile, oblong, slightly cordate at bases, gradually attenuated towards the acutish apices, ca. 1.5 mm. long connectives very slightly produced, sometimes curved inside. Style 0.1–0.5 mm. long, slightly hairy; stigma 1–1.2 mm. long, conical, bilobed, hairy at apex. Fruits globose, lobed, 1.5 mm. high, 2.5 mm. in diameter; nutlets covered with short, white, retrorse hairs, later becoming brown.

DISTRIBUTION: Iran and West Pakistan.

West Pakistan: DADU DIST.: 10–15 km. S. Sehwan, *Rechinger* 28701, 28700 (G, W); *Kazmi s.n.* (PES); *Lamond* 874, 874A (E). KALAT DIST.: ca. 20 km. W. of Bela, W. of Jan Pass, rocky plateau, 300 m., *Lamond* 310a (E); *Rechinger* 2760 (G, W); *Kazmi* 916a (PES); Jal Jhao to Awaran, roadside, mountain area of loose shale, *Lamond* 334 (E); Jal Jhao, 400 m. *Rechinger* 27667 (G, W). KARACHI DIST.: Near Thano Bulla Khan, stony hills, *Jafri* 3710 (E). MAKHRAN DIST.: Punjgur proper, 900 m. *Kazmi* 1217 (PES); *G. Popov* 197 (BM); 20 km. W. of Hoshab, rocky area, sandy soil, 100–200 m. *Lamond* 388 (E); 10–30 km. S-W. of Turbat towards Gwader, 100–300 m. *Rechinger* 27803 (G, W); *Lamond* 423 (E); 30 km. S-W. Turbat versus Pasni, *Rechinger* 27822 (G, W); Hoshab to Punjgur, south of Balagather plain, 8 km. from Hoshab, 600 m., *Lamond* 533 (E); *Rechinger* 28063 (G, W); W. Awaran versus Hoshab, *Rechinger* 27693 (G, W); *Kazmi* 974a. (PES). QUETTA DIST.: Infra Mach, 600–800 m. *Rechinger* 28774 (G, W); between Harnai and Wam Tangi, *Kazmi* 1754 (PES); in alveo 8 km. N-W. Harnai, 900–1200 m. *Rechinger* 29534 (G, W).

20. *H. europaeum* L. Sp. Pl. 130. 1753.

TYPE: "Habitat in Europa centrali" *Herb. No. 179. 8* (LINN).

Annual, stems sometimes woody at the base, usually branched below, erect, up to 45 cm. tall; stem and branches green to grayish green, densely covered with white subpatent hairs 2–10 mm. long, usually arising from minute tuberculate bases. Leaves petiolate, petioles of the lower leaves up to 4 cm. long, shorter in the upper leaves; lamina elliptic-ovate to obovate, slightly attenuate towards the base or truncate, apex obtuse to sometimes roundish, rarely acute, margins entire not revolute, 1–6 cm. long, 1–3.5 cm. broad; nerves on the upper surface inconspicuous, raised and prominent below; both surfaces covered \pm uniformly, with white short (and sometimes longer), usually subpatent hairs, arising from minute but prominent tuberculate bases, longer hairs usually denser on the nerves of the lower surface. Inflorescence usually terminal, sometimes axillary, usually geminate, sometimes ternate, 2–5(–8) cm. long, with closely set

biseriate, ebracteate flowers or fruits. Calyx persistent, sessile, divided nearly to the base, lobes lanceolate, acuminate, erect or at fruiting patent, after falling of the fruits becoming reflexed, 2.5–3 mm. long, 0.5–0.8 mm. broad, densely covered with white, spreading trichomes up to 0.5 mm. long. Corolla 3–3.5 mm. long, tube cylindrical, more or less narrowed at the throat, externally hairy, inside glabrous, lobes suborbicular to subovate or rarely roundish, erect or spreading up to 1.5 mm. long, up to 1.2 mm. broad. Anthers sessile, gradually narrowed towards the acute apices, inserted 0.5–0.8 mm. above the corolla base, ca. 1 mm. long. Style absent to very short, stigmatic disc prominent, 0.4–0.6 mm. in diameter, stigmatic appendage subulate, usually hairy, rarely glabrous, slightly or deeply bifid at the apex, ca. 1 mm. long. Fruits globose, lobed, 1.5–2.2 mm. high and broad; nutlets 4, free, dorsally convex, ovate, glabrous to densely pilose, minutely verrucose to rugulose or rarely minutely tuberculate.

DISTRIBUTION OF SPECIES: From Europe to central Asia.

20a. Var. *europaeum*.

Calyx lobes up to 0.5 mm. broad, acute. Corolla tube not or only slightly narrowed at the throat. Stigmatic appendage deeply bilobed. Nutlets usually glabrous to sometimes pilose, usually rugulose to sometimes tuberculose.

DISTRIBUTION OF VAR.: Europe.

20b. Var. *lasiocarpum* (Fisch. & Mey.) Kazmi, comb. nov.

H. lasiocarpum Fisch. & Mey. Index Sem. Hort. Petrop. 4: 38. 1837; DC.

Prodr. 9: 536. 1845; Riedl in Rechinger, Fl. Iranica 48: 49. 1967.

H. tenuiflorum Bunge, Bull. Soc. Nat. Moscou 42(2): 293. 1869, vix Guss.

H. eichwaldii Steud. var. *lasiocarpum* (Fisch. & Mey.) C. B. Clarke in Hook. f. Fl. Brit. India 4: 150. 1883.

H. ellipticum var. *lasiocarpum* (Fisch. & Mey.) M. Pop. Acta Hort. Petrop. 42: 220. 1931.

TYPE: "Penin. Dardscha" without citation of collector's name (LE-holotype, K-isotype).

Calyx lobes 0.5–0.8 mm. broad, acutish. Corolla tube narrowed at the throat. Stigmatic appendage more or less bifid. Nutlets usually densely retrorse pilose, rarely glabrous, minutely verrucose.

DISTRIBUTION OF VAR.: Transjordan, Syria, Iraq, Iran, Afghanistan, West Pakistan, Kashmir, India, Russia, and central Asia.

West Pakistan: ATTOCK DIST.: Campbellpur, *Rich* 756 (K). BANNU DIST.: arenosis ad viam publicum, 400 m. *Rechinger* 30042 (G, W). CHITRAL STATES: Shishi Col. N-E. of Drosh, 1800 m. edge of fields, *Stainton* 3161 (BM, E). DADU DIST.: Sehwan, *Watt* s.n. (E). DERA ISMAIL KHAN DIST.: Tank, *Bennerji* in *Williams* 7174 (GH, E); Dera Ismail Khan, on right side of Indus, *Schlagintweit* 10810 (GH). GILGIT AGENCY: Gilgit, 1600 m., *R. R. Stewart* 26194 (BM); North of Hindukush, *Giles* s.n. (E); near Gilgit, 1660 m., *McVean* s.n. (E); south of

Hindukush, 1830 m., *Giles* 378 (K). GUJRANWALA DIST.: Khangah Dogran, *R. R. Stewart* 1455 (K). JHELUM DIST.: Sangjoi near Jhelum, *R. R. Stewart* 790 (K); Salt Range, Camp Choia Siadan Shah, *Bis Ram* 450 (GH). KHAIRPUR DIST.: Khairpur Mirs, *Jafri* 1023 (E). KALAT DIST.: Mastung, 1830 m., *Jafri & Akbar* 1786 (E). KARACHI DIST.: Malir, *Jafri* 835 (E); Karachi, *Stocks* 457 (K). KHYBER AGENCY: Landi Kotal, 860 m., *Lowndes* 1724 (E); *Kazmi s.n.* (PES); near Jamrud, *Kazmi* 2483 (PES); Ali Masjid, *Kazmi s.n.* (PES). KOHAT DIST.: Kohat to Thal, ca. 20 km. from Kohat, ditch beside small hillock, 675 m. *Lamond* 1557 (E). KURRAM AGENCY: Kurram valley, *Harsukh* 14671 (K); Shalizan in dry stony soil, *Aitchison* 662 (BM, GH); Parachinar, 1–10 km. E. of Town, roadside shingle plain, 1500 m., *Lamond* 1882 (E). LAHORE DIST.: Walton near Lahore, 330 m. *R. R. Stewart* 14719 (GH); Lahore, *L. S. Das* in *Herb. Lace* 65 (E). MARDAN DIST.: Near Zaida, between Jahangira, weed of tobacco fields, flowers white or nearly so, *Burtt* 618 (E). PESHAWAR DIST.: Shabkadar on Michni Road, *A. J. Ahmad* 66 (PES); Peshawar 330 m., *R. R. Stewart* 9077 (GH); *Kazmi* 2493 (PES); *Schlagintweit* 2632 (E); Peshawar-Charsadda Road, near Naguman bridge, weed of sugar cane fields, flowers white, *Burtt* 976 (E). QUETTA DIST.: Sibi, *Lace* 3886 (E); Jangal, 1500 m. *G. Popov* 225 (BM). RAWALPINDI DIST.: Environ of Rawalpindi, 600–900 m., *Schlagintweit* 10832 (BM); Sangla Hill by canal road, *R. R. Stewart* 1424 (K); near Rawalpindi, 570 m., *Stocks* 457 (K); *R. R. Stewart* 13836 (GH); *Kazmi s.n.* (PES).

Kashmir: Environ of Srinagar, *Schlagintweit* 4587 (BM, GH); Dal Lake, 1800 m. *R. R. Stewart* 3339 (K); Srinagar, 1700 m. *Rich* 1194 (K); Srinagar to Ganderbal, 1800 m. *R. R. Stewart* (GH); Bhimber, *Clarke* 28125 (BM, K); Jhelum valley, Sumbal, 1730 m. *Ludlow & Sherriff* 7710 (GH); vicinity of Pahlgam, on east of Lidder river, 27 miles N. of Islamabad, *Dickason* 96 (MICH).

21. *H. ellipticum* Ledeb. in *Eichw. Pl. Nov. Iter Casp.-Cauc.* 10. t. 4. 1831–33; Riedl in *Rechinger, Fl. Iranica* 48: 48. 1967.

H. eichwaldii Steud. *Nomencl. Bot.* ed. 2. 1: 744. 1840–41; DC. *Prodr.* 9: 535. 1845.

H. littorale Stev. *Bull. Soc. Nat. Moscou* 24(1): 565. 1851.

TYPE: Turcomania: Ad litus orientale maris Caspii prope Krasnowodsk, *Eichwald* (LE).

The only way in which *Heliotropium ellipticum* differs from *H. europaeum* is in having comparatively broader sepals, gradually attenuated to the acute apices, and slightly reticulated, rugose, or indistinctly warted nutlets.

DISTRIBUTION: Armenia, Azerbaijan, Turcomania, Iran, and West Pakistan.

West Pakistan: Reported from Baluchistan: Loralai, Punjgur and Turbat, and from Waziristan: Dwa Warkha and Tank (Riedl. l. c. 1967).

I did not see any specimen of *Heliotropium ellipticum* from West Pakistan or Kashmir. The distinguishing characters given in the description indicate that this species is very close to *H. europaeum* var. *lasiocarpum*. On examining enough material it may prove to be a variety of *H. europaeum* or even identical to var. *lasiocarpum*.

22. *H. ovalifolium* Forssk. Fl. Aegypt.-Arab. 38. 1775; C. B. Clarke in Hook. f. Fl. Brit. India 4: 150. 1883; Cooke, Fl. Bombay Presidency 2: 211. 1908; I. M. Johnston, Jour. Arnold Arb. 32: 111. 1951.

H. kunzii Lehm. Icones 19. t. 29. 1821; DC. Prodr 9: 541. 1845.

H. syenites Spreng. Syst. 1: 539. 1825.

H. brocchianum Visiani, Pl. Aegypt. et Nubia 8. t. 2. fig. 1. 1836; DC. Prodr. 9: 541. 1845, in syn.

H. ambiguum DC. Prodr. 9: 533. 1845.

H. coromandelianum Raddi ex DC. Prodr. 9: 533. 1845.

H. coromandelianum α *obovatum* DC. Prodr. 9: 541. 1845.

H. niloticum DC. *Ibid.*

TYPE: Hadie, *Forsskål*, s.n. (c).

Annual, ascending or sometimes decumbent, commonly branched below the middle 10–40 cm. tall; stems usually several, stem and branches covered with grayish indument of slender pallid trichomes. Leaves petiole, petioles slender, 0.5–2 cm. long, sometimes those of the lower leaves even longer; lamina elliptic, obovate or oblanceolate, margins slightly revolute, apices roundish or obtuse, bases obtuse to acute, midrib conspicuous but veins rarely visible, covered on both surfaces with white, short, appressed trichomes, 1–3(–6) cm. long, 4–12(–27) mm. broad. Inflorescence ebracteate, slender, terminal, usually in pairs, sometimes solitary or ternate, 1–12 cm. long with very numerous crowded small flowers in two ranks, scorpioid. Calyx sessile, divided to the base, 1.5–2 mm. long, lobes unequal, cuneate to broadly lanceolate or sometimes ovate, acute, covered with short, white, appressed trichomes. Corolla white, 2.5–3 mm. long, tubular, slightly narrowed at the throat, limbs campanulate, externally covered with short, white, antrorse hairs, internally, above the middle, with coarse short hairs, tube 1–1.5 mm. long, lobes 0.5–0.8 mm. long, 0.5 mm. broad, ovate-oblong, infolded in bud, later erect or patent. Anthers 0.5–0.6 mm. long, lanceolate, acuminate, inserted about 0.5 mm. above the corolla base. Style absent; stigma 0.3–0.4 mm. long, thick, about 0.3 mm. in diameter at base, conical, apically bidentate. Fruits rounded, about 1.5 mm. high, slightly pointed, with appressed short hairs, breaking up into 4 equal nutlets.

DISTRIBUTION: Africa, Arabia, West Pakistan, India, Indochina, and Australia.

West Pakistan: MIRPUR KHAS DIST.: Gadro, *Zaman & Hussain* s.n. (PFI-M); without locality, in Herb. Wight, *Stocks* 548 (K).

The form and indumentum of the leaves in *Heliotropium ovalifolium* is very variable. It can easily be distinguished from the allied species by its unequal calyx lobes, internally hairy corolla, sessile stigma, and the shape of the leaves.

23. *H. curassavicum* L. Sp. Pl. 130. 1753; DC. Prodr. 9: 538. 1845.

H. glaucum Salisb. Prodr. 113. 1796.

H. glaucophyllum Moench. Meth. Suppl. 147. 1802.

H. chenopodioides Willd. Enum. Hort. Berol. 175. 1809.

H. curassavicum var. *obovatum* DC. Prodr. 9: 538. 1845.

H. virens E. Mey. ex DC. *Ibid.*

H. curassavicum var. *virens* (E. Mey. ex DC.) DC. *Ibid.*

TYPE: "Habitat in Americæ," *Herb. No. 179.11* (LINN).

Perennial, halophytic, decumbent, up to 40 cm. high, stem and branches with leaves more congested in the upper part, hollow, fleshy, glabrous. Leaves pale, glabrous, linear-lanceolate, oblong-lanceolate or narrow spatulate, attenuated towards a short petiole, slightly dilated towards the base, apices usually round, rarely subobtusate; margins entire, nerves not conspicuous on either side, glabrous, coriaceous, up to 5 cm. long and 1 cm. broad. Inflorescence usually terminal, sometimes axillary, simple or geminate, short, scorpioid at flowering, later elongated, up to 6 cm. long, with ebracteate, usually uniseriate, sometimes biseriate flowers or fruits. Calyx persistent, usually sessile, sometimes subsessile, divided nearly to the base, lobes ca. 1.5 mm. long, fleshy, broad lanceolate, obtuse, glabrous, not enlarged at fruiting. Corolla white, ca. 1.75 mm. long, tubular, slightly narrowed at the throat, glabrous, tube 1 mm. long, lobes 0.75 mm. long and broad, ovate, patent. Anthers 0.8 mm. long, 0.3 mm. broad at base, gradually narrowed towards the acutish apices, sessile, inserted ca. 0.2–0.3 mm. above the corolla base. Style absent; stigma 0.5 mm. long, 0.5 mm. in diameter at base, conical, glabrous. Fruits 2 mm. high, slightly broader in diameter, globose, lobed; nutlets 4, glabrous, brown or pale brown, rugulose.

DISTRIBUTION: America, Europe, Africa, West Pakistan, India, East Pakistan, and Australia.

West Pakistan: GURJAT DIST.: Daffar, Pabia (?), *Jan Mohammad 44* (KAU). JHELM DIST.: Salt Range, Daryala Jalep, — 500 m. *Siddiqui 3662* (RAW, BM). KARACHI DIST.: Karachi, *Kazmi s.n.* (PES); *Jafri s.n.* (E); *Nath* in *R. R. Stewart 13120a* (GH); Karachi, Korangi, *Jafri 1452* (E); Malir, *Nath* in *R. R. Stewart 16590* (GH); *Kazmi s.n.* (PES); Malir, Memon Goth, *Tasnif s.n.* (KAU); Drigh Road, *Rahman Beg* in *R. R. Stewart 25723* (MICH); Band Murad Khan, *Tasnif & Aziz 816* (PES); Clifton, in stony and waste places, *Herb. No. 3410* (LAH); *Kazmi s.n.* (PES). LAHORE DIST.: near Shahadra river bank, *Shafi 8268* (LAH). PESHAWAR DIST.: Peshawar-Charsadda Road, at about 8 miles from Peshawar, on both sides of river, flowers white, *Burt 974, 570* (E).

Heliotropium curassavicum is the only halophytic species of the genus with glabrous leaves and glabrous and hollow stems found in West Pakistan.

24. *H. supinum* L. Sp. Pl. 130. 1753; DC. Prodr. 9: 533. 1845; Boiss. Fl. Orient. 4: 127. 1875; C. B. Clarke in Hook. f. Fl. India 4: 149. 1883; Cooke, Fl. Bombay Presidency 2: 209. 1908; Riedl in Rechinger, Fl. Iranica 48: 52. 1967.

Lithospermum heliotropoides Forssk. Fl. Aegypt.-Arab. 39. 1775.

Piptoclaina supine G. Don, Gen. Syst. 4: 364. 1838.

P. malabarica G. Don, *Ibid.*

H. coromandelianum Retz. Obs. Bot. 2: 9. 1781.

H. malabaricum Retz. *op. cit.* 4: 24. 1786.

H. supinum var. *malabarica* (Retz.) C. B. Clarke in Hook. f. Fl. Brit. India 4: 149. 1883.

TYPE: "Habitat Salmanticae juxta agros Monspelii in litore" *Herb. No. 179.8* (LINN).

ICON.: Wight, *Icones Pl. Indiae Orient.* 4: *t.* 1387. 1848.

Annual, prostrate, much branched, branches pale grayish to pale brown, up to 45 cm. long, densely clothed with soft trichomes 0.2–1 mm. long; short trichomes usually retrorse, appressed, the long ones spreading. Leaves petiolate, petioles of the lower leaves up to 3 cm. long, of the upper leaves shorter (a minimum of 3 mm. long), slender, villous; lamina ovate, obovate, ovate-lanceolate, or elliptic, usually subobtuse, rarely acute, margins entire, sometimes slightly revolute, nerves deeply sunken on the upper surface, not very prominent below, 1–2.5(–3) cm. long, 0.5–12 mm. broad; upper surface covered with white, silky, appressed trichomes intermixed with subappressed trichomes up to 1 mm. long, lower surface more densely hairy especially on nerves. Inflorescence much contracted when young, later elongated, usually 2–5(–8) cm. long, with uniseriate flowers, closely set when young, later up to 8 mm. apart. Calyx deciduous, 2–2.5 mm. long, at fruiting much enlarged and up to 5.5 mm. long, subsessile or at fruiting short pedicellate, pedicels up to 1 mm. long, divided 1/4–1/3 of their length, lobes ovate, obtuse, erect or suberect, 1 mm. long, densely covered with appressed and spreading hairs up to 1 mm. long, the divisions between the lobes marked down to the calyx tube by a thin easily tearable membrane. Corolla cylindrical, 2.5–3.5 mm. long, externally covered with short retrorse hairs, glabrous within, lobes rounded, patent, 0.5 mm. long and broad. Anthers 1 mm. long, 0.5 mm. broad at the roundish or \pm truncate base, gradually narrowed towards the acute apex, sessile, inserted about 1 mm. above the corolla base. Stigma conical-elongate, with a prominent stigmatic ring, apex hirsute, 0.5–0.6 mm. long; style \pm equalling the stigma, glabrous. Fruits of usually one developed nutlet or sometimes with 1–2 or rarely 3 abortive ones; nutlets dark brown, rounded and obscurely tuberculate on the back, usually with strong light brown margins.

DISTRIBUTION: South Europe, North Africa, Arabia, Syria, Iraq, West Pakistan, India, and introduced in South Africa and Australia.

West Pakistan: DADU DIST.: Karachi to Dadu, between Amri and Laki, shaded tamarisk woodland, *Kazmi* 2463 (PES); *Lamond* 833 (E); *Rechinger* 28680 (G, W). HYDERABAD DIST.: Hyderabad University Campus, *Kazmi* s.n. (PES). MIRPUR KHAS DIST.: Gadro, *Zaman & Hussain* s.n. (PFI-M). Miscellaneous: north-west India, *Royle* s.n. (K).

5. *Sericostoma* Stocks ex Wight, *Icones Pl. Indiae Orient.* 4(2): 15. *t.* 1377. 1848.

TYPE SPECIES: *S. pauciflorum* Stocks ex Wight.

Small strigose branched shrub. Leaves alternate. Flowers small, axillary, sessile, solitary, or the upper in a bracteate raceme. Sepals 5, narrow. Corolla tube short, mouth wide, closed with hairs; lobes 5, imbricate in bud, obtuse, spreading. Stamens 5, subincluded; anthers oblong, obtuse. Ovary deeply 4-lobed; style short; stigma subcapitate. Nutlets 4, ovoid, substipitate, scar basal; receptacle flat.

A monotypic genus restricted to West Pakistan and adjoining West India.

S. pauciflorum Stocks ex Wight, *Icones Pl. Indiae Orient.* 4(2): 15. *t.* 1377. 1848; Hook. *Icon.* 9: *t.* 804. 1852; C. B. Clarke in Hook. *f. Fl. Brit. India* 4: 175. 1883; Cooke, *Fl. Bombay Presidency* 2: 220. 1908; Riedl in Rechinger, *Fl. Iranica* 48: 54. 1967.

TYPE: Scinde: Baikur prope Deesa, *Stocks s.n.* (K-holotype; GH, w-isotypes).

Small perennial, woody at the base, branched, erect or suberect shrub, 10–50 cm. tall; herbaceous stem and branches covered with loose, short, appressed trichomes, usually deciduous with age. Leaves linear, lanceolate or oblong-ovate, 5–35 mm. long, 2–5(–10) mm. broad; nerves and veins inconspicuous on the upper surface, slightly raised below, both surfaces uniformly and loosely covered with short appressed trichomes arising from tuberculate bases in the older leaves; margins entire, apices subacute to obtuse. Inflorescence terminal rarely axillary, short, usually 2–6-flowered, becoming loose and longer with age, up to 10 mm. long, bracteate, bracts much reduced, 1–2 mm. long. Calyx deciduous at maturity, subsessile, 2.5–3 mm. long, slightly enlarged at fruiting, deeply divided, lobes lanceolate, acute, subequal, \pm imbricate, hairy. Corolla 3–3.5 mm. long, up to 5 mm. in diameter, lobes 2 mm. long, 1.5 mm. broad at base, rounded to ovate, spreading and recurved, throat densely hairy, annulus represented by a narrow band of trichomes just above the base of corolla tube. Filaments equal, 0.8–1.1 mm. long, affixed at the summit of the corolla throat directly beneath the base of the corolla sinuses; anthers slightly longer than filaments, exerted. Style 1–1.3 mm. long, shorter than the nutlets; stigma terminal. Gynobase plane or even depressed at the center. Nutlets with a short downwardly directed stipe bearing the attachment at its lower end, ovoid-oblong, 2–2.5 mm. long, 1.5 mm. broad, slightly tuberculate, brownish.

DISTRIBUTION: West Pakistan, India.

West Pakistan: KARACHI DIST.: Between Hawkes Bay and Bungalow village, *Kazmi 864* (PES); inter Damloti et Khadiji, in arenosis, *Rechinger 28499, 28501, 28515* (G, W); Cape Monze, *Rechinger 27516* (W); Sonmiani, *Rechinger 27545*,

27546 (w); Hab Cauki, *Rechinger* 28585 (w). Miscellaneous: Nagar Parker, *G. Popov* 349 (BM); Baikur prope Deesa, *Stocks s.n.* (GH, K, W).

The leaves of *Sericostoma pauciflorum* vary from very short linear to broadly ovate-oblong, up to 3.5 cm. long, but this variation cannot be correlated with any character of the floral parts or any geographical area in its distribution.

6. **Bothriospermum** Bunge, Enum. Pl. Chin. Bor. 47. 1832.

TYPE SPECIES: *B. chinense* Bunge.

Weak annual or biennial herbs. Leaves alternate, ovate to lanceolate. Flowers small, blue or white, axillary, pedicellate, the upper going off into a bracteate raceme. Calyx 5-partite, lobes free at the base, narrow, not or slightly enlarged in fruit. Corolla tube short, cylindrical, throat with 5 scales, lobes imbricate in bud, later spreading. Stamens 5, included; anthers ovate, obtuse. Ovary deeply 4-lobed; style short; stigma capitate. Nutlets 4, ellipsoid, granular-scabrid, inverted, parallel, their backs proximate with a double bony margin, tumid and inconspicuous, with a small apical or subapical attachment.

Species 3 to 4, all of them occurring in China and one extending up to Japan in the east, and Afghanistan, Pakistan, and India in the southwest.

B. tenellum (Hornem.) Fisch. & Mey. Index Sem. Hort. Petrop. 1: 23. 1855; DC. Prodr. 10: 116. 1846; C. B. Clarke in Hook. f. Fl. Brit. India 4: 167. 1883; Kashyap, Lahore Dist. Fl. 171. 1936; Riedl in *Rechinger, Fl. Iranica* 48: 56. 1967.

Anchesta tenella Hornem. Hort. Hafn. 1: 176. 1815.

Cynoglossum diffusum Roxb. Fl. Indica ed. Wall. 1: 7. 1824.

C. prostratum D. Don, Fl. Nepal. 100. 1825.

TYPE: "Hab. in China" in Herb. Vahl (as *Anchusa zeylanica*).

Prostrate, much branched at base, branches slender, simple or slightly branched, 8–25 cm. long; stem and branches covered with short appressed trichomes. Basal leaves obovate, lower cauline leaves petiolate, obovate-lanceolate to lanceolate, upper lanceolate, sessile, all between 15–30 mm. long, 3–8 mm. broad; margins undulate, apices acute; uppermost leaves bract-like, 7–8 mm. long, \pm 2 mm. broad. Flowers pedicellate, pedicels 3–4(–5) mm. long, axillary, the upper going off into axillary racemes. Calyx \pm 2 mm. long, divided to the base, lobes linear-lanceolate. Corolla \pm 2.5 mm. long, tube equalling the calyx, lobes rounded, \pm patent, throat with 5 trapeziform scales, emarginate at the apices. Anthers ovate, obtuse, included. Stigma capitate; style short. Nutlets \pm 1 mm. long, ellipsoid, granular-scabrid, inverted, parallel, their backs proximate with a double bony margin, tumid and inconspicuous, with a small apical or subapical attachment.

DISTRIBUTION: Afghanistan, Pakistan, India, China, Manchuria, Japan, Philippines, Mascarene and Hawaiian Islands.

West Pakistan: LAHORE DIST.: Lahore, *Sahai s.n.* (κ). Miscellaneous: Where Chumuck joins the Jhelum, *Aitchison 364* (κ).

7. *Echiochilon* Desf. Fl. Atlant. 1: 166. 1798.

TYPE SPECIES: *E. fruticosum* Desf.

Usually perennial plants. Inflorescence with numerous flowers, usually elongating and becoming unilaterally racemose. Calyx persistent, divided nearly to the base, lobes valvate or at least not evidently imbricate. Corolla small to large, radially symmetric to strongly zygomorphic, corolla lobes shorter than the tubular portion. Filaments deeply affixed in the corolla throat. Stigma subterminal always surpassed by the protracted sterile tip of the style. Gynobase elevated, attenuate, usually narrowly pyramidal and more than half the length of the nutlets. Nutlets with a prolonged sessile lateral attachment.

Species 17, distributed in North Africa, Arabia, Iran, and Pakistan.

E. persicum (Burm. f.) I. M. Johnston, Jour. Arnold Arb. 38: 288. 1957;
Riedl in Rechinger, Fl. Iranica 48: 58. 1967.

Heliotropium fruticosum L. var. *persicum* Burm. f. Fl. Indica 41. t. 19. fig. 1. 1768.

H. persicum (Burm. f.) Lam. Encycl. Méth. Bot. 3: 94. 1789.

Lithospermum kotschyi Boiss. & Hohen. var. *brevifolium* Bornm. Mitt. Thür. Bot. Ver. 6: 59. 1894.

L. persicum Gaud. Bull. Soc. Bot. Fr. 65: 62. 1918.

Sericostoma persicum (Burm. f.) B. L. Burtt, Kew Bull. 1949: 138. 1949.

TYPE: Persia, *Burmann f. s.n.* (G-DC).

ICON.: Burm. f. l. c. t. 19. fig. 1. 1768 (as *Heliotropium fruticosum* var. *persicum*).

Decumbent shrub, old stems becoming woody, up to 8 mm. thick, usually branched above the middle, branches 5–15 cm. long, covered with straight, appressed trichomes 0.5–1 mm. long. Leaves usually ascending, oblong or oblong-lanceolate, thickish, 3–15 mm. long, 1–3 mm. broad, weakly conduplicate or the upper surface merely somewhat concave, lower surface convex, not costate; lowest 2–3 pairs of leaves on the shoot opposite, others alternate. Inflorescence racemose, unilateral, 3–8 cm. long, 10–20-flowered, terminating the leafy shoots and their branches, bracteate, bracts oblong, shorter than the calyx. Calyx at flowering 3.5–4 mm. long, lobes 2.5–3 mm. long. Corolla 4.5–6 mm. long, tubular-funnelformed, abaxial side 1–1.5 mm. shorter than the adaxial side, outer surface minutely villulose, lobes ascending, 1–1.5 mm. in diameter, margins crisped, throat bearing abundant yellow hairs inside, annulus usually marked only by an indistinct band of minute hairs about 0.5 mm. above the corolla base. Anthers 1.2–1.7 mm.

long, usually included; filaments 0.5–0.8 mm. long, unequal, borne at unequal heights, 2.3–3 mm. above the corolla base. Style 0.9–1.5 mm. long; stigma very short, low convex. Gynobase 1.5 mm. tall, abruptly narrowed above the broad base, base about 1 mm. broad. Nutlets 2–2.3 mm. long, above the base 1.5–1.7 mm. broad, gray or pinkish, usually one or more aborted, back convex, obscurely roughened or with a few scattered prominent tubercles; areola green, vertical or rarely somewhat oblique, abruptly contracted into a narrow groove extending upwards to above the middle of the nutlet.

DISTRIBUTION: Coastal areas of southern Iran and West Pakistan.

West Pakistan: Sind: Hala Range, *Vicary s.n.* (κ).

The species most closely related to *Echiochilon persicum* appears to be *E. kotschyi* of the Islands of the Persian Gulf. The insular species, however, is very distinct, differing from *E. persicum* in its practically smooth nutlets, few-flowered inflorescence, small recurved leaves, and in its regular rather than zygomorphic corollas.

[*To be continued*]